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DIESEL RAILWAY TRACTION

A Supplement illustrating and describing developments in Diesel Railway Traction is presented with each copy of this week's issue.

Britain's Foreign Visitors

CORONATION year is to be expected to result in a bumper crop of visitors to these islands, but, of course, it is too early to form any accurate impression of the figures involved. Analysis of the returns for the first quarter of the year, however, shows something of the increases that have resulted from even the Coronation preparations. The Travel and Industrial Development Association states that the number of holiday visitors from foreign countries to the British Isles during the first three months of this year show an increase of 4,347 over the corresponding period of 1936, the record year. The 1937 total is 31,230; the 1936 figure was 26,883. According to the Home Office return for March this year the total number of holiday visitors was 13,434, an increase of 4,043 compared with March of last year. The business visitors (8,172) were 74 down compared with the total of March, 1936. The combined total of holiday and business visitors was 21,606 compared with 17,637 in the March of last year, an increase of 3,969. These figures do not take into account week-end and day visitors from France and Belgium nor the numerous overseas British visitors—estimated at a normal annual figure of 200,000—who travel with British passports and are not recorded at the ports.

Rugby League Cup Final Traffic

London at the present time is being overwhelmed by successive waves of invasion, only some of which recede at once, and, of course, the Coronation influx has grown day by day for some weeks past. The Association Cup Final on May 1 attracted the usual heavy influx, and again last Saturday tens of thousands of excursionists from the North were brought to London by 112 special trains for the Widnes *v.* Keighley Rugby League Cup Final match. The L.M.S.R. and the L.N.E.R. must have congratulated themselves on their good fortune in securing such heavy patronage for the second Saturday in succession. The latter company arranged for 48 excursion trains, mostly from the West Riding of Yorkshire, and the former provided 64 specials to Euston and St. Pancras. Restaurant and buffet car accommodation was given on a number of trains, and on the L.M.S.R. meals were served to over 9,000 passengers. The specials arrived in London from 4 a.m. onwards on Saturday morning and the task of returning the excursionists to their home stations was accomplished between 10.30 p.m. the same night and 2.45 on Sunday morning, with the exception of one train from Euston, which left at 4.30 on Sunday afternoon. The special non-stop service between Marylebone and the Stadium station at Wembley was again in operation.

* * * *

Excursions for Canoeists on American Railways

Encouraged by the success of their winter ski trains and summer bicycle trains, railways serving New York City are now planning a new sport to be indulged in with the co-operation of the railways. The new sport—canoeing in a collapsible craft—is being introduced by the New York, New Haven and Hartford Railroad about the middle of this month, when a combined bicycle and canoe train will make its first trip to a small village in Connecticut, whence the canoeists can make an 18-mile trip down the Housatonic River. The collapsible boats will be provided on the train, and bicycles for those wishing to remain ashore. About forty rapids will be encountered on the downstream voyage, and at the most difficult of them the train will stop to enable those remaining aboard to watch their friends navigate or swim. The canoes, made of a light hard-wood frame with metal fittings, are said to bounce off a rock like a ball, and are 90 per cent. puncture proof. These boats, called Faltboote in Germany where the sport has long been known, hold one or two people, and are propelled by double-biaded paddles. Their weight is only 40 lb., and so can be carried easily when the rapids are too arduous.

* * * *

Grand Union Canal Developments

As a result of the reorganisation of the board of the Grand Union Canal Company and the adoption of the recommendations of the three new directors who have been constituted a committee of investigation and for economies, increased all round efficiency is expected to be obtained as well as the carrying out of considerable economies. Long-distance traffic is being steadily developed by the Grand Union Canal Carrying Co. Ltd., which created further increased revenue of £13,440 in 1936, against £4,718 for the corresponding year 1935, and the tonnage originating on the canal increased by 116,000 tons, or about 7 per cent. Before the recent sharp rise in iron and steel prices, the carrying company prudently ordered a number of craft which it was known would be required ultimately, and these craft are likely to provide the additional revenue which the Canal Company requires to pay a fair return on the money spent on canal improvements.

Canadian Pacific Prospects

Sir Edward Beatty at the annual meeting of the Canadian Pacific Railway in Montreal on May 5, expressed confidence in the company's position based on Canada's rapid progress towards recovery. He showed that notwithstanding the diminution in earnings from grain and grain products which had followed the poor harvest of the past season, the gross earnings of the company for the first quarter of 1937 increased 8·1 per cent., and the net earnings by 28·8 per cent. Passenger earnings improved by 5·6 per cent. and freight earnings by 7·6 per cent. With reference to wheat and its vital importance in Canadian economics, Sir Edward Beatty pointed out the adverse effects of widespread drought conditions in Western Canada in recent years, but with the world's visible supplies of wheat diminishing and the average farm price of wheat advancing there was every reason to expect that traffic to and from agricultural areas over the Canadian Pacific system and also over the Soo line would increase substantially in the next few years. The Coronation had stimulated bookings on the Atlantic by the Canadian Pacific steamships. There was also an increased demand for cargo space, both eastbound and westbound, and on the Pacific ocean traffic was being maintained at the same level as a year ago.

* * * *

Spain and the Franco Decree

The acceptance by General Franco's new National Party of the programme of the Falangists has had the effect of defining the position of industry under a Franco Government. With the publication of the new Decree, business interests are able to form some idea of the probable fate of private enterprise generally after the civil war. The Valencia government on the one hand is committed to some form of Marxist control by the workers (or "collectivisation" as it is described in Catalonia), and the workers' control of the railways actually in force under the decrees of the Madrid and Valencia Governments has already been described in our Overseas columns. Now the Franco decree promises another form of control. The Salamanca Government has been at some pains to make it clear that the Nationalist programme is not really "Fascism," although the Falangists, whose programme is now being adopted almost in its entirety, have always been described as "the Spanish Fascists." But the programme itself admittedly promises a "totalitarian" State; there would be no pretence of a democratic form of parliament and yet all Spaniards would take part in the government through their "municipal and syndical" functions. Private initiative would be encouraged, where compatible with collective interests and the nation would be organised in one gigantic syndicate of producers by means of a system of "vertical syndicates."

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The Future of Spanish Railways

From the point of view of the railways, the main feature in the ambitious (and possibly over-ambitious) proposals recorded in the previous note is the control of private enterprise and industry in the interests of the community. Marxism is repudiated, but so also is any form of capitalism which ignores the elementary rights of the workers or the claims of private property. The tendency is accepted towards some form of nationalisation of banks and public services, within the general lines of the totalitarian State. In this it differs from the acknowledged aim of the government of Sr. Largo Caballero which frankly plans for control in the interest of the "workers." The principal obstacle to the success of either plan is the individualism so pronounced in the Spanish character. One of the causes of the breakdown of the old system was precisely the conflict of individualities, and the Cortes failed to find legislative remedies for many abuses because of the clash of personalities and the lack of any sense of self sacrifice or civic discipline. It does not appear likely, in any event, that the railways will ever return to their original form of private enterprise, but it is, of course, too early to forecast the shape railway administration may take in the future as this depends primarily on the outcome of the civil war.

* * * *

British Influence on U.S.A. Rolling Stock

In an address given to a club at Alameda, California, by Mr. A. A. Lowe, recently appointed Assistant to the General Manager of the Southern Pacific Railroad, a generous tribute was paid to the influence of the L.M.S.R. "Royal Scot" locomotive and train, when travelling over 11,000 miles of American and Canadian lines in 1932, on subsequent American rolling stock practice. "Railroad officials who accompanied the tour of the 'Scot,'" he said, "were amazed at the easy riding of the train and the lack of jerk or slack action in starting and stopping. Engineers were set to the task of finding out how such power was developed in a locomotive of that size, which amounted to a pigmy alongside the giants of the rails used in the United States. The secret was finally found—light weight! Here the American trains had been towing tons and tons of useless steel and iron, while officials wondered why their trains could not develop higher speeds." The subsequent outbreak of streamlining, coupled with new light-weight stock, in the United States the speaker attributed to the smooth exterior and modest weight of the British stock, of which the entire 8-coach train, locomotive included, weighed a shade under 400 tons—the weight of five standard American Pullmans alone. However, the speaker was unduly modest in his references to what the U.S.A. has done in the speed realm in existing conditions, for the article on American speeds which appeared in our March 26 issue showed that the fastest steam-operated run in the world today is performed by the Pennsylvania Railroad with standard non-streamlined locomotives and coaches.

* * * *

High Speed and Track Occupation

Some noteworthy figures were given in a paper read recently by Mr. F. G. Gurley, an Assistant Vice-President of the Chicago, Burlington & Quincy Railroad, to the Western Society of Engineers in Chicago, concerning high speed trains. Pointing out that on his line a 5 min. margin is allowed for the clearance of freight trains ahead of passenger trains, and that this has been increased to 10 min. in the case of the diesel-electric Zephyr services, he remarked that the westbound Denver Zephyr runs from Chicago to Denver in 16 hr., as compared with the 27¾ hr. taken by the Aristocrat, which is the fastest of the steam-hauled trains over this route. "This means," he said, "that the Zephyr allows 11¾ hr. more time for the uninterrupted use of the main track by other trains. The importance of this is that the Zephyr passes on double track, or meets and passes on single track, a total of 20 trains between Chicago and Denver. If the Aristocrat left Chicago at the same time as the Zephyr, but continued to operate on its slower schedule, the number of trains so met and passed would be increased to 29." This is a striking commentary on the oft-repeated assertion that the high speed train monopolises an undue share of the running lines over which it is operated, though it is only fair to add that the density of main line track occupation in this country is in general vastly greater

than on the lines west of Chicago. Another interesting point made by the speaker, which also confirms general experience, is that his company's high-speed passenger trains, particularly during the bad weather conditions of 1936, had a better " on time " record than the other express services.

* * * *

Elimination of Level Crossings in the U.S.A.

The vast Federal programme of level crossing elimination and protection throughout the United States, estimated to cost $200,000,000 is now well under way. By February 28 last $58,486,577 had been spent, 854 crossings had been eliminated, and a further 108 protected with signals. On that date also work upon the elimination of 881 level crossings and the protection of 309 was in hand, involving an expenditure of another $102,853,221; the total number of projects then approved was over 3,000. So greatly has this important programme been speeded up during the six months, August 31, 1936, to February 28, 1937, that in that period 604 eliminations, 113 reconstructions, and 96 signal protections of crossings were completed. The programme is in accordance with the Emergency Relief Appropriation Act of 1935, and funds are provided for it by appropriations by Congress at the rate of some $50,000,000 a year. The individual States and the railways, however, bear the costs of land and damages, but on the projects already approved these total only about $4,000,000. It is not clear what proportion of this sum has to be borne by the railways, but it is obviously insignificant as compared with the corresponding expenditure from the Federal Exchequer. We are indebted to our American contemporary the *Railway Age* for the figures.

* * * *

Mechanical P.W. Maintenance in Germany

During the last ten years the German State Railway has been making wide use of mechanical appliances to facilitate and cheapen track maintenance. Mechanical track layers were used by German contractors in Asia Minor in the nineties, while such a machine, designed by a member of the railway staff, was used in the construction of the Tongen-Aachen line during the war, when little skilled labour was available. The results obtained with the Bretland equipment in Ireland appear to have given fresh impetus to the study of the subject, and led several German engineers to produce machines of their own. An account of some of them appears in the *Organ für die Fortschritte des Eisenbahnwesens*. They vary a good deal, some, such as the Neddermeyer machine, being entirely hand worked and reducing the exertion necessary rather than eliminating men, while others require, to a greater or less degree, some source of power, saving men and speeding up the work. The Niemag, Mohr and Federhaff, and Hoch devices have all been used. An interesting appliance is the petrol-driven ballast roller, first tried in 1924 near Nuremberg. It was not very successful at first, being too heavy, but, after lightening, has given excellent results. Many machines are now in service, frequently fitted with removable flanged wheels, so as to move under their own power along the line.

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Ballast and Formation

At the forthcoming International Railway Congress in Paris the question of increasing speeds and heavier loads and their effects on the permanent way is to be discussed. There are, of course, many factors to be taken into consideration, but the matter of supreme importance is to assure a suitable track which shall not only be amply strong to carry the travelling loads, but shall present a level top and perfect alignment in all circumstances with the minimum attention. To achieve this, the first principle of permanent way design must be meticulously observed, namely, to construct the track in such a way as to assure that the concentrated load transferred from the steel wheel to the rail shall be transmitted through the sleepers and ballast to the formation with due regard to the bearing capacity of the various materials concerned. The day when chances could be taken as to the weight per unit area that they could bear are gone. The materials themselves must, of course, be impervious to changes of nature in varying weather conditions, or, in regard to the formation—over the choice of which the engineer has no control—it must be so protected as to prevent weakening under varying conditions. Ample drainage and a sufficient depth of suitable ballast are of primary importance, and it is necessary to face expenditure in providing these where they do not already exist if heavy loads and higher speeds are to be economically and safely operated.

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Metallurgy and Freight Car Design

A freight car inventory taken last year in the United States revealed that there were 763,863 freight cars on the railways in that country more than 20 years old; 298,695 between 16 and 20 years old; and 431,991 between 11 and 20 years old. In addition, cars with more than 6 but under 11 years' service numbered 279,957. It is expected that with recovery from the trade depression freight and passenger vehicles will be built in increasing numbers, and one of the most important improvements is that savings can be effected by using materials which will reduce the tare weight of the vehicles, while increasing their capacity and reducing maintenance costs. One of the most significant directions for achieving this is the use of high tensile steels, which can be in lighter sections than regular carbon steels for the same service because of their superior physical and corrosion-resisting properties. The stress and the yield point of the high tensile steels is usually between 50,000 lb. and 60,000 lb. per sq. in., whereas that for low-carbon steels ranges between 25,000 lb. and 35,000 lb. per sq. in.; ultimate stress of between 65,000 and 90,000 lb. per sq. in. for the high tensile steels compares with ultimate stress between 48,000 lb. and 65,000 lb. for regular carbon steels

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Design for a Turbine Locomotive

Among the interesting new locomotive designs which will shortly materialise on the French railways is one worked out by the O.C.E.M., in collaboration with Schneider & Co., for a 4-6-4 type turbine-driven locomotive capable of developing 2,500 metric h.p. This is intended for the haulage of very fast trains involving maximum speeds of 140 km. or 87 m.p.h. In this case the boiler pressure is 25 hpz. (362 lb. per sq. in.) and the boiler and accessories are of the conventional type. Three independent, geared turbines are provided, driving a corresponding number of axles and each consisting of an impulse turbine rotating at 10,000 r.p.m. for forward running and a special turbine for reverse running. The high speed of turbine rotation necessitates the use of double-reduction gearing, driving on the Westinghouse system, which provides an elastic connection between the turbine, solid with the locomotive frame, and the wheels in contact with the rails. This system requires the use of outside frames and the axleboxes are of the double-row roller bearing type. The locomotive is non-condensing. New designs for reciprocating locomotives prepared under the same auspices are illustrated and described on pages 939-40 of this issue.

XUM

A Coronation Retrospect

AT the beginning of the present reign we remarked that it was customary to consider the commercial development of this country as a series of epochs, each represented by the span of reign of the Sovereign. On this basis the accession, and subsequent coronation, of a new monarch is the beginning of a new era and marks a period when writers devote considerable space to optimistic forecasts for the future, and even more attention to complacent reminiscences of bygone days. So far as transport is concerned, the comparatively short reign of Edward VII was notable chiefly for achievements at sea, such as the development of the turbine and the exemplification of its possibilities in the famous *Mauretania*. The reign of George V was characterised by the rise of road transport and aviation, although future generations may very probably see even greater importance in the rejuvenation of railways throughout the world. Nevertheless, the basic development of the power-operated public railway which has made modern civilisation possible is essentially a feature of the Victorian era. To provide a striking contrast, therefore, between conditions "then and now" it is necessary to look back to the beginning of Victoria's reign. Fortunately, a timely volume by Miss Margaret Lambert has not only made this possible to everyone but has also done this in a most fascinating way, and her book "When Victoria Began to Reign" is full of attractive tit-bits on every aspect of life in this country a century ago.

It is 99 years, to be exact, since Queen Victoria was crowned on June 28, 1838, a year after her accession to the throne, and Miss Lambert had the happy idea of projecting her readers back into the social scene at the opening of the Queen's reign by means of extracts and illustrations from all kinds of contemporary sources—newspapers, books, diaries, letters, broadsheets, and so forth—knit together with a running commentary that provides an extraordinarily interesting and entertaining picture of the time. Regarding transport of the period, we are given a reminder that to the traveller of 1837 a railway trip offered at least as much excitement as an aeroplane trip today. The death of Huskisson, a one-time President of the Board of Trade, who had stepped into the path of a locomotive as yet unprovided with brakes, served as a vivid reminder of the new form of danger attendant upon the introduction of railway travel and its high speeds. At this period coaches, and especially the mail coaches, had a great reputation for punctuality; indeed, they are said to have set the time for the countryside. In sharp contrast to this, early railways were often anathematised in private correspondence for their lack of punctuality, and there was also much grumbling in letters to *The Times*. An example from Miss Lambert's collection is as follows:—

> I was a passenger by the two o'clock train to Box Moor yesterday and was informed at the London station that little more than one hour would be occupied in the passage. The fact proved very different, as we did not reach Box Moor until the expiration of two hours and a quarter from the time of starting from Euston Square. The train scarcely went a snail's pace through the Primrose Hill tunnel . . . . and we did not reach Harrow under one hour and eleven minutes—eleven miles. We loitered about thirteen minutes at Harrow, some time at Watford, and met with a most confused and uncomfortable reception at Box Moor.

Of course, it must not be assumed that early railways were without their keen admirers, and doubtless many visitors to the Metropolis for Queen Victoria's coronation must have experienced similar feelings to those of Charles Greville, who, after his first railway trip (on July 18, 1837) said "Nothing could be more comfortable than the vehicle in which I was put, a sort of chariot with two places; and there is nothing disagreeable about it but the occasional whiffs of stinking air, which it is impossible to exclude altogether. The first sensation is a slight degree of nervousness, but a sense of security soon supervenes and the velocity is delightful." The vigour with which the Eton authorities tried to prevent the railway from being built, lest it demoralised the boys, is well known; less frequently quoted, however, is the attitude of the University of Cambridge at a later date, when the Vice-Chancellor felt it must be as displeasing to Almighty God as it was to himself that the railway should take Sunday excursionists to Cambridge. But the railways were equally vigorously defended, and one of the advantages which Miss Lambert reminds us was expected to accrue from them—that England would be able to dispense with a large standing army—makes curious reading today.

* * * *

Coastal Carriers and Exceptional Rates

AN issue of very great importance concerning the right of representative bodies of traders to be heard by the Railway Rates Tribunal in objection to the proposed introduction of exceptional rates has recently been settled by the Court of Appeal at the instance of the Chamber of Shipping of the United Kingdom. The facts are that on May 26, 1936, the Great Western Railway applied for the consent of the tribunal to put into operation three exceptional rates which were more than 40 per cent. below the appropriate standard charges for the conveyance of grain between the Bristol Port Group and Truro, Penryn, and Penzance. An objection to the grant of these rates was lodged by the Chamber of Shipping on the grounds that the proposed rates would divert traffic hitherto carried by coastwise carriers who are members of the chamber; would place such carriers at an undue and unfair disadvantage; and, by reason of their prejudicial effect upon the interests of coastwise shipping, be undesirable in the national interest. It was contended before the tribunal on July 24 on behalf of the railway company that, under Section 37 (1) of the Railways Act, 1921, the only consideration which the tribunal is required to exercise is to decide whether the proposed rates would affect prejudicially any class of users of the railway not benefited by such rates, or would jeopardise the realisation of the standard revenue. Further, that as the objection lodged by the chamber did not refer to these matters, it was not entitled to take part in the proceedings. The Tribunal upheld this contention, refused to hear the chamber, and sanctioned the grant of the proposed rates.

The chamber then appealed against this decision, contending that any representative body of traders was entitled under Section 78 (3) of the Act to object to an application for the grant of exceptional rates under Section 37 (1), and that the tribunal was not so limited in its consideration as it had decided. The appeal came before the Court of Appeal on March 2-3, when all the Lords Justices upheld the contention of the G.W.R. that a representative body of traders had no right to object to the proposed exceptional rates on the ground that they might affect detrimentally the business of competing carriers. The Court also pointed out that Section 39 of the Railways Act, 1921, and Section 39 of the Road and Rail Traffic Act, 1933, prescribe special steps which may be taken by representative bodies of traders who consider that any exceptional rates are competitive with other forms of transport so as to be undesirable in the national interest; but these provisions relate only to rates actually in operation and not to proposed rates. Accordingly the Court upheld the decision of the Rates Tribunal and dismissed the appeal of the Chamber of Shipping.

Welded Rail and Flat-Bottom Track

WITH the tendency to use longer rails to minimise the number of rail joints, the question of the lateral strength of the track to avoid buckling, under the inherent compressive stress induced in the rails when expansion is prevented, becomes of great importance. The avoidance of movement between rail and sleeper so as to obviate longitudinal movement of the former relatively to the latter, and so to distribute the inherent stresses evenly, is a primary necessity when facilities for expansion are not provided. With the standard type of bull-head track used in this country the rails are held in cast iron chairs by means of wooden or steel keys; but whereas the former do not, and are not supposed to give a positive fastening, experience seems to show that an efficient spring steel key does prevent movement between rail and chair. When expansion gaps of sufficient width to permit free expansion under temperature rise are left between the end of adjacent rails, it is not logical to prevent the movement of the rail in the chair. Similarly the fastening of flat-bottom rails to the sleepers or soleplates should also be loose enough to permit of the free movement longitudinally of the rails under the influence of varying temperatures.

The tendency, in the design of flat-bottom track to carry heavy high-speed loads has, however, been towards a positive fixing of the rails to the soleplate or sleeper, so that the rail cannot expand and contract freely. In such a design it is therefore illogical to provide gaps between rails to allow for an expansion that cannot take place, at any rate to its full extent, and indeed this aspect of the matter seems at last to be receiving due recognition, for not only are expansion gaps now often too small to permit of complete expansion, but on an increasing number of railway systems they are being practically eliminated. In New South Wales and Victoria, for example, it has been the practice for several years past to weld rails together into continuous lengths of 225 ft. in straight track. It is, of course, important when this is done to make the track as rigid as possible so that the compressive stress induced in the rails when they cannot expand under a rise of temperature shall not cause distortion of the track. As compared with bull-head track the flat-bottom type is more rigid for this purpose. The rail itself has greater lateral strength owing to the wide bottom flange, and the fastening that can be made between the flange and the soleplate is more positive than that which it is possible to make between the web of the rail and a cast iron chair. The tests, described in this issue, which are now being carried out on the L.M.S.R. main line between flat-bottom and bull-head track, are of importance in this connection, for the results may lead to far-reaching developments in the construction of our main line permanent way.

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The Rehabilitation of the Chinese Railways

A COMPREHENSIVE survey of measures taken by the Chinese Government since 1931 to rehabilitate its railways was given in the paper by Mr. Kenneth Cantlie abstracted on page 951, but to obtain a clear idea of the desperate position of the railways throughout China then, and appreciate the needs of the situation, a brief historical review of events leading up to that date will be helpful. Apart from the ill-fated Shanghai—Woosung railway,* which was so soon demolished, the first line in China was built by a mining company and was later worked as a private railway. It was found, however, that the difficulty of raising private Chinese capital made it desirable for the Chinese Imperial Government to intervene in order to complete an extension of the line to the capital, Peking. As Chinese capitalists were still reluctant to invest in railways, even under Government ægis, the Chinese Government obtained a foreign loan by an issue of bonds through the Hongkong and Shanghai Bank under certain stipulations by the bank which took the form of a loan agreement. These conditions stipulated that, through the appointment of Britons to key posts on the railway, a large measure of financial and administrative control should be in their hands. The arrangement might be considered a modification of the system of foreign railway companies such as was and is successfully operated in South America and other countries, and was created to meet the not unnatural desire of the Chinese to have at least nominal control of the only modern means of communication in the Empire.

The refusal to entertain the idea of foreign-controlled private railway companies under strict Government inspection was also caused by the system of legal extra-territoriality then and now in force under which the subjects of important nations were under consular, and not Chinese, jurisdiction. This system, which was a modification of that adopted in the Turkish Empire in the 16th century, though excellent in theory, has not, for various reasons, had good results in China, and in practice has sometimes hampered progress, as in the present case. The original loan agreement concluded between the Chinese Government and the Hongkong and Shanghai Bank, as the agents for foreign bondholders, has been regarded as a model, and has been imitated to a greater or less extent by later loan agreements.

The ensuing period in China's history was an unsavoury one. China had been so greatly weakened by the Sino-Japanese War that it seemed to the world that the break-up of the Empire was at hand, and each great power manœuvred to prevent any other power from seizing part or all of it. These manœuvres often took the form of forestalling other nations in their attempts to secure railway and other concessions, and also of enhancing as much as possible their trade with China. In consequence there followed what has been called the " battle of concessions." In so far as railways are concerned, the powers saw that railway concessions were not only politically desirable, but economically profitable, and competition in this sphere was keen, and several of China's major railways came into existence as a result. The Boxer rising called a halt to these politico-economic manœuvres, and after the Russo-Japanese War, the enhanced comparative strength of Britain and the United States in China caused a relaxation of the expectation that China was shortly to be divided up by the powers, and the clamour for political railway concessions died away. Thereafter loans for railway construction were made upon a business basis, though, as the lenders were still supported by their Governments, this often resulted in political pressure being put upon the Chinese Government. Many Chinese as a consequence, not unnaturally failed to note the fundamental difference in the basis of the loans, and could see little improvement in China's position. In justice to all parties it might be pointed out that though political pressure was frequently used to procure further advantages for foreign syndicates, it was also much used to overcome obscurantism, petty restrictions and favouritism on the part of some of the officials. Nevertheless, though the results may often have been good, pressure of this kind could not fail to cause resentment in such a justifiably proud nation as the Chinese. Meanwhile, the scrupulous care with which payment was made on the railway bonds as they came due, improved China's credit rapidly, and the terms on which

* This line was referred to in our review, on page 1057 of our issue of December 25 last, on " The Chinese Railways."

Chinese railway bonds could be sold on foreign markets became progressively easier. As a result, loan agreement safeguarding clauses (employment of foreign staff, deposition of funds, &c.), became less and less stringent.

In 1911 the Chinese Imperial Government decided to take back direct control of the trunk railways from the Provincial Governments, and this was the immediate cause of the revolution which resulted in the displacement of the Manchu Dynasty. The effect of the revolution on the railways was not great, and after a short pause, the flow of foreign funds and materials to China for railway construction was actually accelerated. The great war, however, caused an absolute cessation of foreign lending, and its aftermath of financial confusion prevented any renewal of interest in Chinese railways. In the meantime China had begun that long period of civil wars which, reminiscent as they were of England's Wars of the Roses, were extremely confusing to outsiders, and caused conservative foreign financial interests to await tranquillity before re-entering the investment field. Railways, being the sole modern means of transport, naturally suffered severely during this period, and the foreign railway officers, whose dual duties under the loan agreements were to safeguard not only the rights of the Central Government but also the interests of the foreign bondholders, were placed in an invidious position, and had to endeavour to withstand the requirements of the various war lords and governors in whose territories they chanced to be. In consequence, a large majority of the foreign staff, and also many of the experienced Chinese staff, on the various railways were removed, and their substitutes were frequently military or political appointees, whose knowledge of railway matters was sometimes small. The rise of the Nationalists in 1926 was followed by their split with the Communists in 1927 and the foundation of Nanking as the capital of the country. Prior to the split much Communist propaganda had been spread, and this had caused a large fall in the efficiency of the various railways, especially in shops and sheds, due to decay of discipline. It therefore became decreasingly possible to repair the damage done to the railways by the civil wars. Then in addition to the heavy damage to rolling stock resulting from the wars came the wholesale removal of locomotives, carriages and wagons by the Old Marshal, Chang Tso-Lin, when he retreated to "the Three Eastern Provinces" (as the Chinese call Manchuria), and this equipment was used by him on the new railways which he built in Manchuria, and little of this stock ever returned to the owning railways (mainly the Peiping-Hankow, Tientsin-Pukow, Peiping-Suiyuan, and Lung-Hai).

In 1929 the National Government occupied Peking—the name of which was changed from Peking (Northern Capital) to Peiping (Northern Peace)—and there came a period of peace. A Ministry of Railways was then established—formerly the railways had come under the Ministry of Communications—under one of the highest Government leaders to endeavour to rehabilitate them, for by then they were in a deplorable condition. On some lines as many as 60 per cent. of the locomotives were out of service, and the condition of the rolling stock was almost as bad. Interest on bonds was in arrears on almost all lines, and repayment of, or even interest payments on, the large material loans which during the wars had been made on increasingly onerous terms, was also impossible. Before palliatives were possible, yet another war broke out, led by certain discontented leaders then in the north. For six months the struggle continued along the Peiping-Hankow, Tientsin-Pukow, and the Lung-Hai lines, and still more damage was done. The final peace found the majority of the railways in a condition little short of chaotic, with but a small proportion of serviceable rolling-stock, over-age and rotten sleepers, patched and weakened bridges, a shortage of spares of all kinds, an insubordinate staff whose salaries and wages were heavily in arrears, and an enormous mass of both long-term and short-term indebtedness which increased inexorably year by year, much of it at heavy compound interest. That was the problem facing the Ministry of Railways in 1931.

PUBLICATIONS RECEIVED

When Victoria Began to Reign : A Coronation Scrapbook. By Margaret Lambert. London : Faber & Faber Limited, 24, Russell Square, W.C.1. 9in. × 5½ in. × 1¼ in. 319 pp. Illustrated. Price 12s. 6d. net.—This is a fascinating reconstruction of the social scene at the opening of Queen Victoria's reign, covering, by means of quotations knit together with a running commentary, all aspects of public life. In an editorial article on page 928 we deal at some length with the section devoted to transport.

The Enemies of Timber. Published by the Technical Department of Cuprinol Limited. 8½ in. × 5½ in. 48 pp. Fully illustrated. Price 1s.—This well-produced booklet deals with the effects of the two chief enemies of wood, fungi and boring insects. To preserve timber against these a treatment is necessary that will not (*a*) impair its appearance ; (*b*) lose its effect due, for instance, to evaporation ; (*c*) be dangerous to handle or poisonous ; (*d*) render it unsuitable for painting ; or (*e*) require heating. It is claimed that these conditions are complied with by the use of Cuprinol, effective against both the "enemies." The booklet contains an interesting treatise on dry rot and the conditions causing its destructive action on wood, and also others on different forms of fungi. Dealing with dry rot, both indoors and out-of-doors, the methods of preventing and checking it are outlined. The life-cycle of the insect "enemy" and its extermination also form the subject of a chapter, special attention being given to the death-watch and other destructive beetles and their activities. Treatment with Cuprinol in various ways is recommended in all cases.

The Simplon-Orient and Taurus Expresses. — The extensive international connections afforded by the Simpon-Orient and the Taurus Expresses are set out in an attractive illustrated booklet published by the Compagnie Internationale des Wagons-Lits. On the coloured cover is a map showing the overland route from London to Basra and Cairo provided by these two trains and their connecting services. A graphical timetable insert includes plans of the formation of the Simplon-Orient Express, in each direction, so that the user least familiar with tracing connections from timetables of any type can see at a glance precisely what through coaches are provided, and the days of the week on which they run. The booklet contains several views of the types of sleeping and restaurant car accommodation of which the trains are composed, and devotes a double page of illustrations, with railway map, to the different countries through which the services run.

Railway Wagon Discharging Appliances.—Various types of wagon tipping equipment are illustrated in this catalogue from Babcock & Wilcox Limited, Babcock House, Farringdon Street, London, E.C.4. For end tipping, the firm instals electric or hydraulic rams, on overhead hoisting gear, examples of which are shown in service. Rotary tipplers, for side-opening wagons or any other type, occupy a large section of the catalogue. The smaller types have electric driving mechanism, with hand or hydraulic clamping. Larger machinery is made for handling two 10-ton wagons simultaneously. Other types of tippler include installations with hoisting gear for coaling plants, and a special pattern for covered wagons with side doors only.

THE SCRAP HEAP

Answer to Railway Problem No. 5

80. Five passengers started in train from 6th stopping place, made up of 1 who got in and half those who started from 5th stopping place. ∴ 8 started from 5th stopping place, made up of 2 who got in and half those who started from the 4th. ∴ 12 started from the 4th. Similarly 18 started from the 3rd, 28 from the 2nd, 46 from the 1st, and 80 from X.

Railway Problem No. 6

PENALTY £5

A professor of economics, travelling from London to Birmingham in a train going at 40 m.p.h., pulled the communication cord just after a train from Birmingham to London, proceeding at 50 m.p.h., had passed his train in 3½ seconds.

The reason he gave for doing so was that he wished to know the length of the train in which he was travelling. It cost him £5 to learn that the answer to his query was 84 yd.

Just as a matter of curiosity, what was the length of the Birmingham to London train?—*From "A Problem a Day," by R. M. Lucey. Faber & Faber. 5s. net.*

Reproduced by courtesy of the editor of the "Storyteller"

"A trifle over-zealous are we not, Ramsbotham?"

Forty-five years ago, the proposal of the G.C.R. to appear in the exclusive St. John's Wood district, en route to its London terminus at Marylebone, aroused a storm of indignation, not only from the cricketers of Lords under whose ground it was intended to pass, but from the artists' colony, led by the late Sir Lawrence Alma-Tadema. It also caused Charles Bignell to protest in song on behalf of the district :—

There'll be no more garden parties,
No *al fresco* evening teas,
No strolling in the gloaming
While the wind sings in the trees,
Only snorting, thumping engines,
With a clatter and a wheeze—
That's what the future's going to be.

It cannot be said, however, that this musical form of opposition had any adverse effect on the aggressive Great Central Railway, which, acting on the supposition of "what Manchester thinks today, England will think tomorrow," had decided that its line to London was a national necessity, and was determined to provide the Lancashire capital with a fourth main line route to London.

* * *

ST. PANCRAS CATHEDRAL!

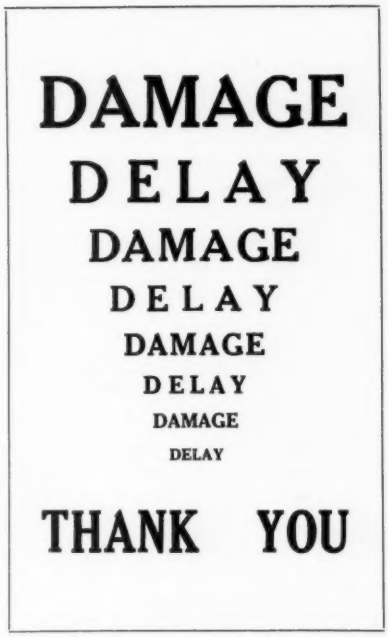
The tale is told of the old days that a newcomer to London, who was lodged in a Bloomsbury square, inquired one Sunday evening where he might find a typical metropolitan place of worship. A fellow-boarder, who thought himself a clever fellow, told him: "Walk down as far as the Euston Road, you know, that dangerous road where the horse-buses are forever clattering past, and ask for St. Pancras . . . ." The stranger did as he was told, and came eventually to a building of over-powering bulk which in the flickering of the gas lamps he took to be early medieval. Mounting the steps, he was met by a gorgeously dressed individual. "How oddly he is dressed," he thought; "but, of course, they *do* do things differently up here," and then aloud: "What time is your service?" To which the other reprovingly replied: "Ours, sir, is a 24-hour service!" St. Pancras does look like a cathedral. At night-time, ridiculously like, with its towers and turrets and spires and mock buttresses.—*Kenneth Adam in "The Star."*

* * *

The railway activity at Glasgow Central station, L.M.S.R., is being exploited in rather an unusual way by a well-known city store. The rear windows of the premises face that part of the station which lies in the open air, and the proprietors of the store invite their customers to spend some time watching the arriving and departing trains. To assist them seats have been arranged at the windows with the best viewpoints. This unusual gallery is advertised at the entrance to the store, and during the school holidays it attracts large numbers of schoolboy patrons. According to the poster, the view from the gallery includes some of the world's most famous trains. The windows face directly on the platform from which the Royal Scot makes its daily departure, and a splendid bird's-eye view is obtained of the 13 parallel tracks across the Clyde bridge.

* * *

Speed, of course, is but one of the essential factors in the maintenance of railway passenger service, but the safety index for the year 1935, when no single rail passenger was killed in the United States in a collision or derailment, is on a par with it. Rail luxury is sufficiently exploited to need no comment, but its combination with swiftness and safety forms a spectacular pattern in the fabric of the tradition of American railroading.—*From the "New York Herald Tribune."*



No. 12 of a new series—the third—of "claims prevention" posters issued by the Chief Goods Manager, G.W.R., for exhibition to the staff

OVERSEAS RAILWAY AFFAIRS

(From our special correspondents)

NEW ZEALAND

New Constructions

Modern machinery is enabling rapid progress to be made with the construction of the various new lines, particularly the East Coast railways of both the North and South Islands. It is estimated that on the line in the North Island, trains may be running between Napier and Wairoa by the end of July next, thanks to the remarkable progress that has been made lately with work of rehabilitating and completing that section of the line.

Although there are other relatively minor works to be completed, the entire project is really governed by progress on the Mohaka viaduct, which was the principal single undertaking left unfinished when the work was suspended in 1931, and which, when completed, will be the largest structure of its kind in the Southern Hemisphere.

Mohaka Viaduct

According to present calculations the viaduct will be completed in the early autumn, some time before this was expected. The same period will suffice for the completion of other minor works as well as for clearing and restoring the balance of the permanent way which had been laid before 1931. Progress on the viaduct itself has been remarkable, for it is only a few months since the concrete foundations on the sides of the gorge and caissons standing out from the river were the only signs that a large engineering work had been begun and abandoned. Today piers and steel spans towering more than 300 ft. above the river level foreshadow the early completion of the great undertaking.

FRANCE

Motorbuses to Replace Trains on Vincennes Suburban Line

The Est has notified the authorities of the Seine Department that it has decided not to proceed with the proposed electrification of the Vincennes subsidiary suburban line running from the terminus in the Place de la Bastille, Paris, to Verneuil-L'Etang. The Est also announces that it intends to discontinue the steam passenger train service on the Vincennes line. The passenger trains will be replaced by motorbuses under the control of the departmental transport system. At one time it was planned that the Paris Metropolitan should take over the line, when electrified, and run a suburban service similar to that which will come into operation toward the end of the year on the line from the Luxembourg terminus to Sceaux, when the Paris-Orleans completes the electrification now in progress and transfers the line to the Metropolitan.

Paris Metro Finances

Traffic receipts of the Paris Metropolitan in February amounted to fr. 41,876,324, against fr. 42,645,288 in February, 1936. Receipts for the Paris lines were fr. 39,898,236 against fr. 40,787,151, and for the suburban extensions fr. 1,978,078 against fr. 1,855,137. The 40-hr. working week became effective throughout the Metro system on April 1.

New Metro Extension

An extension of Paris Metro No. 1 line—which runs right across the city from east to west—was opened as far as the bridge over the Seine at Neuilly on April 28. Neuilly is a residential suburb much favoured by English residents, and the new line will take them down to the Seine just below the point where it leaves the Bois de Boulogne.

UNITED STATES

Increased Public Interest in Railways

Interest in railway affairs on the part of the lay public is growing rapidly in America. On Sunday, April 11, cheap excursions were run for the public desirous of inspecting the works of the American Locomotive Company at Schenectady, special trains being operated from New York, Boston and Buffalo. As long as a week before the date, all available accommodation had been booked, as a limit had to be placed in order not to overcrowd the workshops. In all, 3,200 passengers made the journey (via the New York Central Railway), and at least double that number would have gone could the necessary arrangements have been made. High officers of both the railway and the locomotive works (including the presidents of both companies) accompanied the trains and mingled on friendly terms with the passengers. Other similar cheap trips to see railway sights are planned for the near future, one of which will include the great Altoona workshops of the Pennsylvania Railroad.

At Atlantic City in June, during the annual meeting of railway mechanical engineering officers, there will be on display the first comprehensive exhibition of railway appliances since 1930. These exhibitions were formerly held each second year. In view of the lapse of time, and the accelerated pace at which invention and improvement has been occurring, the 1937 exhibition is expected to be an unusually interesting one; and this year, for the first time, the general public will be invited to attend.

The cultivation of public interest and friendship has been deliberate and intensive on the part of the railways, and their efforts are beginning to bear a rich harvest.

Rolling Stock Purchases Continue

In the first three months of the current year the railways ordered 108 locomotives, 27,613 freight cars, and 386 units of coaching stock, a large increase in all categories over the same period last year. Interest rates on borrowings to finance rolling stock purchase remain low (3 per cent. and less), but prices of raw materials are advancing. The steel manufacturers in particular have increased their prices sharply, because the steel works are running at capacity, and because they have lately conceded heavy increases in wages to their employees (as the result of the unionisation activities of the Committee for Industrial Organisation, which staged the "sit-down" strikes in the motor manufacturing industry).

ARGENTINA

Grain Prices Soaring

Argentina is at present on the crest of a wave of prosperity, consequent upon the high prices being paid for grain and other products of the country. At the time of writing, wheat has risen to $15 (18s. 9d.) per 100 kg. (220 lb.), and very high prices are being quoted for linseed and maize; in fact, not since the war have they been so high. The phenomenal jump of wheat and linseed has, perhaps, come too late to be of much benefit to the farmers although all the crop was sold at remunerative rates, as most of what remains is in the hands of the exporters; but with maize still to be harvested and the prices offering being higher than they have been for years, the farmers should reap the full benefit. Unfortunately for the railways, they have not a sliding scale of rates, governed by commodity prices, so that they are not benefiting directly by the boom, although indirectly they will do so in the shape of increased passenger movement and traffics in general merchandise and agricultural machinery, always the sequel to prosperity in the agrarian districts.

Railways Seek Participation in General Prosperity

The managements of the British-owned railways have applied for permission to increase the grain tariffs, but this step has raised the usual storm of opposition, and there are at present no signs of the Government being in sympathy with the request. In any case, much of the wheat has already been carried, but something might be done in this respect in regard to maize, which after all would be only fair and just, in view of the fact that the last maize crop was carried at a considerable reduction in transportation rates, on account of the low prices then ruling, and in return for concessions from the Government in the matter of exchange.

The Argentine Rural Society, which is the representative organisation of *estancieros* and farmers, has strongly condemned the proposed increase in railway rates, action which is hardly equitable, bearing in mind that the transportation companies have generally been willing to grant concessions when prices have been so low as to leave little or no margin of profit to the grower and producer. Now that prices are soaring, this disinclination to allow the railways to share in such unprecedented and unexpected prosperity hardly savours of fair play. However, the last word has not yet been said.

Abnormal Demand for Grain Forces Prices Up

The cause of this abnormal rise in grain values is not very apparent, but one can only conclude that the possibility of a European war has something to do with it. It is known that France and Italy, for some time past, have been heavy buyers of wheat, although their own crops will soon be coming to market. Argentina has still some 1,400,000 tons of wheat to ship, and there is a large maize crop to be transported. There was considerable damage done by drought in certain districts, but the chief maize zone—that served by the Central Argentine Railway—was not affected, and taken all round, the crop will be a large one. The boom in wheat will no doubt result in a heavy increase in the acreage put under this commodity this year, so that 1938 will probably be characterised by overproduction and a swing back in prices. In the meantime, however, Argentina is making the most of what the gods have sent her, and the railways are looking forward to sharing in the general prosperity, brought about by this astonishing rise in values.

Silver Jubilee of the B.A. Provincial Railway

The 25th anniversary of the opening of this railway (owned by the Buenos Aires Provincial Government) was celebrated on March 17, on which date 25 years ago the first train ran from La Plata to Saladillo Norte, a distance of 250 km. To mark the occasion, a lunch was given by the railway administration, at which some 1,200 persons were present, including Engineer Bustillo, Provincial Minister of Public Works, and other representatives of the Provincial Government; Señor Vicente A. Suarez, General Manager of the Railway; Señor Juan V. Cilley, ex-General Manager; Señor Elodoro T. Lugones, ex-Chief Accountant, and Señor Rodolfo Van Koy, the driver of the inaugural train. Speeches were made by Señor Suarez and the Provincial Minister of Public Works.

Tank-Wagons for State Railways

The National Government has authorised the State Railways administration to purchase 100 tank-wagons for the transport of petroleum and water, at a cost of $200,140 (U.S.). These wagons, which will be purchased direct, without calling for tenders, are intended for use on the lines at present under construction from Pie de Palo to Mendoza, Joaquin V. González to Pichanal, and Tostado to General Pinedo.

BRAZIL

Paulista Railway

At a time when the majority of Brazilian railways are recording large deficits and struggling against a series of difficulties, it is gratifying to know that this railway concluded the year 1936 with a very encouraging surplus. Gross receipts from working amounted to 116,324 contos made up as follow:—

	Contos
Passengers	21,482
Special trains	34
Platform tickets and funeral coaches...	110
Animals, luggage, and parcels ...	5,483
Registered packages	53
Animals in passenger trains	154
Telegrams	819
Goods	76,002
Animals in goods trains	5,521
Storage charges	156
Rents on locos., coaches, and wagons...	2,162
Rents on station premises	210
Miscellaneous	746
	112,933
Profits realised by Northwestern Railway Improvements Society Ltd. ...	1,688
Forest services	286
Unclassified revenues	1,417
	116,324

Expenditure increased from 66,440 contos in 1935 to 71,239 last year, leaving a credit balance of 45,085 contos to which must be added the balance of profit amounting to 14,641 contos brought forward from 1935. Out of this total the sum of 2,101 contos was contributed to the employees' pension fund and 3,199 contos were absorbed in the payment of interest on external debts. Sums of 1,000, 339 and 141 contos were set aside for the Reserve Fund, Forest Services Fund, and Traffic Expansion and Improvements Fund, respectively. After paying, in addition, 5,369 contos interest on imported materials and distributing 31,576 contos in dividends to shareholders the appreciable sum of 16,000 contos is carried over to next year.

CHINA

Proposed Kiangsi-Fukien Line

Another important trunk railway that is being considered is the Kiangsi—Fukien, or Kweichi—Foochow, north-to-south line, which, when completed, will give direct communication between Nanking and the capital of Fukien Province, the port of Foochow on the South-east coast midway between Hong Kong and Shanghai. [This line was briefly referred to on page 743 in our issue of April 16.—ED. *R.G.*]. The survey of it is now in hand, and it is roughly estimated that it will cost $35,000,000, a cost that will be borne by the Central and Provincial Governments of Fukien and Kiangsi. The Kweichi—Yenping (Nanping), or northern section of this line is being undertaken first.

Kweichi will be an important junction, in that the Shanghai and Nanking lines to Canton meet at this point. When a fourth line to Foochow is added it will become a large railway centre. The new line will open up several hundred miles of untapped country and will knit the south-east of China to the Capital.

INDIA

New Railway

The Government of India has sanctioned the construction, by the Bikanir Durbar, of a metre gauge railway from Sadupur, a station in Bikanir, to Rewari on the B.B. & C.I.R., a distance of about 85 miles. The new railway will pass through Bikanir, Loharu, Nabha and British Indian territories, and will cost about Rs. 40 lakhs.

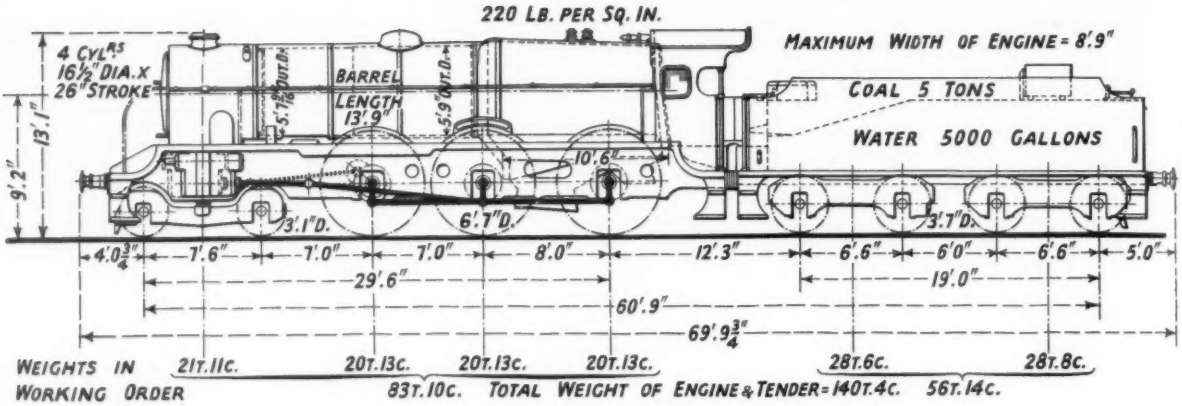
Increase in Surplus Expected

The total approximate gross earnings of all State-owned railways from April 1, 1936, to March 31, 1937, amount to Rs. 95·35 lakhs. This sum is more by Rs. 35 lakhs than the revised estimate shown in the Railway Budget two months ago. The budgeted railway surplus of Rs. 15 lakhs is thus increased to Rs. 50 lakhs. There is, however, a possibility of the surplus being still further increased as past experience has shown that the actual audited figures of earnings usually show an advance on the approximate figures. It is also noteworthy that all railways except the Bengal-Nagpur contributed to the increase in earnings; the two-months' strike on that system was the cause.

Capital and Depreciation Fund Programme: G.I.P.R.

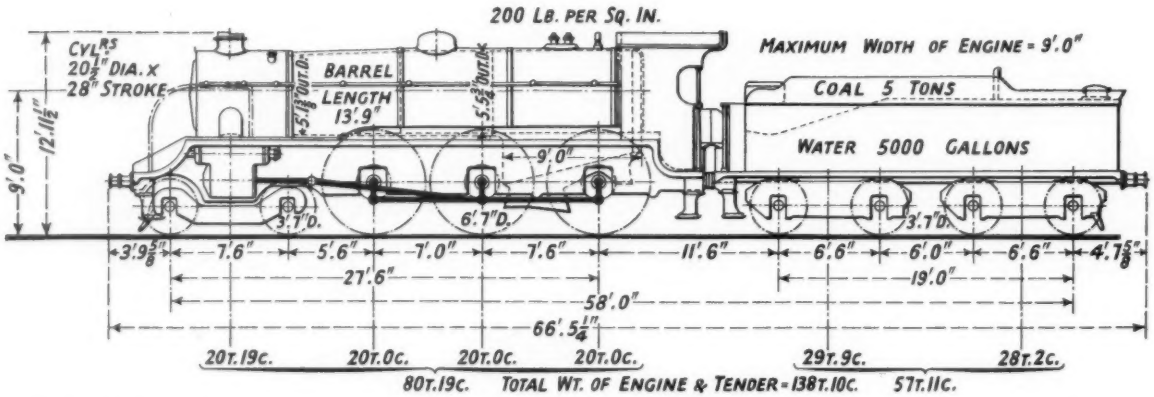
A sum of Rs. 43 lakhs is provided for open line works on the G.I.P.R. during the year 1937-38, most of the expenditure being from the Depreciation Fund. Track renewals form the major item in the works programme. Funds are provided for the completion of the remodelling of the locomotive depots at Dhond and Jhansi and of the yard at Dhond. A new scheme has been prepared to control the 12 sub-stations providing power for electric traction between Kalyan, Igatpuri and Poona from a central point. The consummation of this work, at a cost of Rs. 2·97 lakhs, promises to result in an annual saving of about Rs. 46,500. In addition to the provision for expenditure thrown forward from the previous year, the Rolling Stock Programme includes funds for the replacement of 21 broad and 4 narrow gauge boilers and for the construction of 6 inspection carriages as additions. It is also proposed to obtain 26 bogie electric coaches and 73 "CR" type wagons.

British Locomotive Types—XII



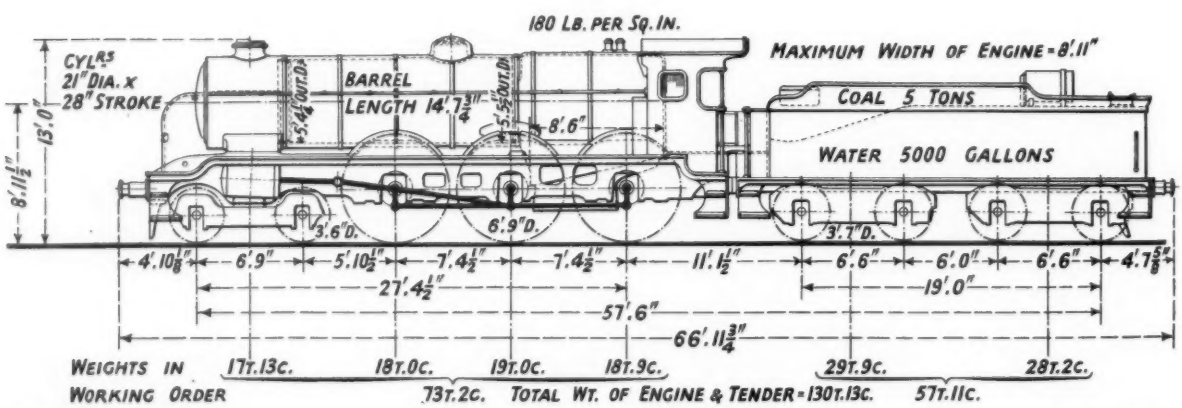
HEATING SURFACE, TUBES—		SUPERHEATER	376·0 SQ. FT.
LARGE AND SMALL	1,795·0 SQ. FT.	COMBINED HEATING SURFACES	2,365·0 ,,
FIREBOX	194·0 ,,	GRATE AREA	33·0 ,,
TOTAL (EVAPORATIVE)	1,989·0 ,,	TRACTIVE EFFORT (AT 85 PER CENT. B.P.)	33,500·0 LB.

Class "Lord Nelson"



HEATING SURFACE, TUBE—		SUPERHEATER	337·0 SQ. FT.
LARGE AND SMALL	1,716·0 SQ. FT.	COMBINED HEATING SURFACES	2,215·0 ,,
FIREBOX	162·0 ,,	GRATE AREA	30·0 ,,
TOTAL (EVAPORATIVE)	1,878·0 ,,	TRACTIVE EFFORT (AT 85 PER CENT. B.P.)	25,320·0 LB.

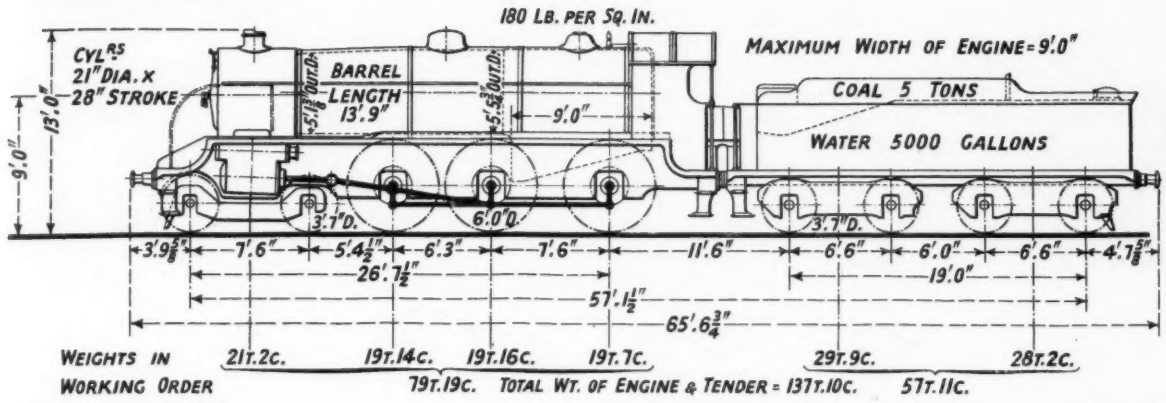
Class N. 15 "King Arthur"



HEATING SURFACES, TUBE—		SUPERHEATER	383·0 SQ. FT.
LARGE AND SMALL	1,664·47 SQ. FT.	COMBINED HEATING SURFACES	2,199·55 ,,
FIREBOX	152·08 ,,	GRATE AREA	26·68 ,,
TOTAL (EVAPORATIVE)	1,816·55 ,,	TRACTIVE EFFORT (AT 85 PER CENT. B.P.)	23,300·0 LB.

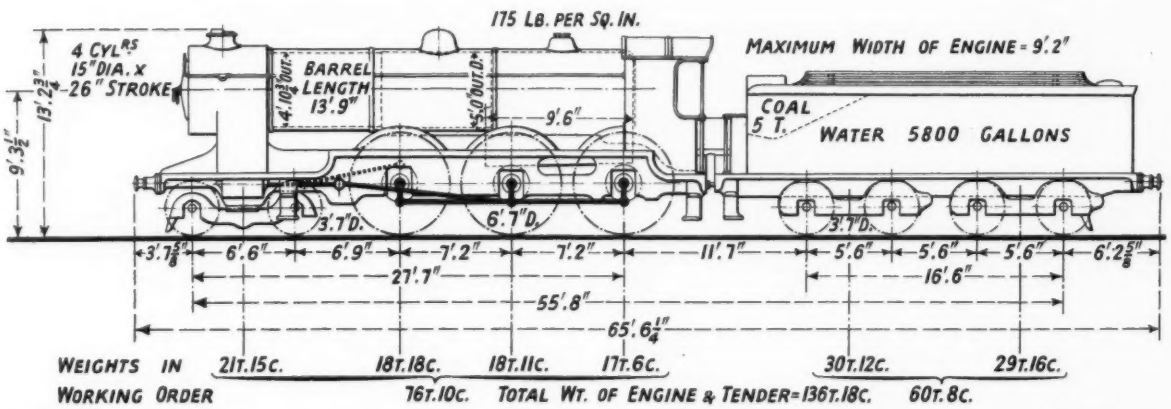
Class N. 15/X "Remembrance."

Southern Railway



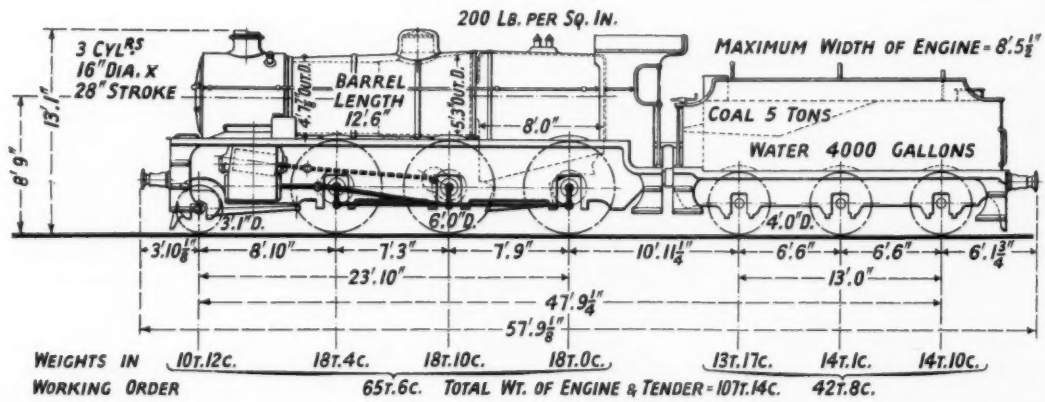
HEATING SURFACE, TUBES—		SUPERHEATER	337·0 SQ. FT.
LARGE AND SMALL	1,716·0 SQ. FT.	COMBINED HEATING SURFACES	2,215·0 ,,
FIREBOX	162·0 ,,	GRATE AREA	30·0 ,,
TOTAL (EVAPORATIVE)	1,878·0 ,,	TRACTIVE EFFORT (AT 85 PER CENT. B.P.)	26,200·0 LB.

Class H. 15



HEATING SURFACE, TUBES—		SUPERHEATER	295·0 SQ. FT.
LARGE AND SMALL	1,280·0 SQ. FT.	COMBINED HEATING SURFACES	1,733·0 ,,
FIREBOX	158·0 ,,	GRATE AREA	31·5 ,,
TOTAL (EVAPORATIVE)	1,438·0 ,,	TRACTIVE EFFORT (AT 85 PER CENT. B.P.)	22,030·0 LB.

Class T. 14



HEATING SURFACE, TUBES—		SUPERHEATER	285·0 SQ. FT.
LARGE AND SMALL	1,390·6 SQ. FT.	COMBINED HEATING SURFACES	1,810·6 ,,
FIREBOX	135·0 ,,	GRATE AREA	25·0 ,,
TOTAL (EVAPORATIVE)	1,525·6 ,,	TRACTIVE EFFORT (AT 85 PER CENT. B.P.)	25,387·0 LB.

Class U. 1

THE EVOLUTION OF RAILWAYS—II

By CHARLES E. LEE

ALTHOUGH there is little doubt, therefore, that the origin of railway permanent way for the exclusive use of vehicles with flanged wheels is to be found in mediæval German mining practice, the development of the railway as a public means of transport took place entirely in Great Britain. So much was this the case, that, although railways continued to be used extensively in Continental mines, European countries, as indeed all other parts of the world, received from us almost as an invention the public railway using steam as a motive power for the transport of both passengers and goods. In fact, even the mining wagon-way in its improved form as used extensively in the eighteenth century in the Co. Durham mining areas was adopted in certain parts of the Continent as an English device, and when it was introduced into the Ruhr district at the end of the eighteenth century it was referred to[9] as an *englischer Kohlenweg*.

So far it has proved impossible to fix with any great precision the date on which mineral railways were first adopted in England. One of the difficulties experienced in examining early documents is that of terminology, for the word railway was comparatively a late comer and although rails are referred to in very early years, the term for a line of rails was a " waggon-way." " Tramway " and " tram-road " are not words of great antiquity (contrary to popular impression) although " tram " is. Probably the earliest use of the word " tram " in connection with a highway is to be found in the will made by Ambrose Middleton, of Skirwith (County of Cumberland) and Barnard Castle (County Durham), dated August 5, 1555, by which a sum of money was left for the repair of a highway or tram. On more than one occasion this has been quoted as an early reference to a railway, but failing more definite evidence than is known to the present writer to exist, the reference should be interpreted with caution, especially as the word " tram " is used as the alternative to highway. In old Scandinavian " traam " or " trum " meant a beam of wood, and as such came into the English language, especially in the North.

A Scottish legal decision[10] of 1601 refers to the " tram or beam of the gibbet." This is an interesting mention of the word tram as it is clearly shown as an accepted term in the North meaning a beam. As it is not until two centuries later that we find the word tram used to mean a railway, we are perhaps on safer ground in assuming that the Middleton will of 1555 referred to a log road.

In its old meaning of a beam, the word " tram " became associated with transport as the name for a quadrilateral frame on which baskets of coal were conveyed. At first it was probably carried by bearers; then dragged like a sledge; and afterwards provided with low wheels on which to run. I would emphasise, however, that there appears to be no evidence of the combination of the word " tram " with " way " or " road " until the late years of the eighteenth century.

It is in the closing years of the sixteenth century that we find our first definite reference to rail transport in this country. Manuscripts preserved by Lord Middleton at Wollaton Hall (near Nottingham) were recorded by the Historical Manuscripts Commission in 1911, and among them is a contemporary week-by-week coal account for the period from October, 1597 to October, 1598, which refers to " railes " and implies that in 1597 there was a wagon-way from the pits at Wollaton and Strelley to the River Trent. Some writers have expressed doubt as to whether it is justifiable to accept even this reference because of its vagueness, but the matter is made almost certain by another manuscript[11] at Wollaton Hall dated May 1, 1610, which says " I beseeche you take order with Sir Thomas [Beaumont] that we mai have libertie to bring coales down the rayles by wagen for our cariadges onely, and we will bring them down by raile ourselves, for Strelley cartway is so fowle as few cariadges can pass."

Huntingdon Beaumont seems to have been the common factor in the introduction of wagon-ways both in the Nottinghamshire and the Northumberland coalfields, and it is probable that he was responsible for this development. The manor of Coleorton in Leicestershire had belonged to the Beaumont family at least since the beginning of the fifteenth century, and the Coleorton coal mines seem to have been the most important in the county during the time of Queen Elizabeth. In 1586 Coleorton colliery was in the hands of Sir Henry Beaumont, and Huntingdon (a younger brother) went outside the family estates to find an outlet for his energies. He was a friend of the Willoughby's of Wollaton, and probably played a part in the development of the neighbouring Strelley and Bilborough mines. Sir Phillip Strelley appears to have leased to the Byrons (a family of Lancashire coalowners) his manors of Strelley and Bilborough for the nominal sum of £20 per annum for 21 years from May 16, 1597, and this seems to have been the beginning of progressive management and rail transport there. The Byrons sold the remaining 15 years of their lease to Huntingdon Beaumont[12] on October 2, 1603, for £4,000, and he took up residence at Bilborough. The enormous increase in the value of the lease shows clear evidence of considerable development within six years, for much of which the wagon-way was doubtless responsible, and, as the Byrons seem to have taken very little interest in the property, it is a fair assumption that Beaumont inspired the introduction of modern methods even before he bought the lease.

We next find traces of Beaumont's activities in Northumberland in the neighbourhood of the river Blyth. In 1595 Peter Delaval, a London merchant, obtained from the Crown a lease of mines in the coalfields of Cowpen and Bebside, near Bedlington, but the enterprise failed. The lease was taken over by a Midland group that also failed to make the mines pay, and on September 9, 1605, Huntingdon Beaumont (described as " of Bilborough ") with four London merchants bought for £374 3s. 4d. the remaining years of the lease and during the next few years spent[13] upwards of £6,000 on equipment.

In an account[14] of the Newcastle coal trade, published

[9] " Geschichte des Eisen," by Beck.

[10] See " Household Words " of January 26, 1856.

[11] A letter written by a Midland coal dealer who had contracted to market the output of Sir Percival Willoughby's colliery at Wollaton. Sir Thomas Beaumont (a brother of Huntingdon), who was knighted in 1603 and died in 1614, was financially interested in the Strelley and Bilborough mines, as was also the eldest brother, Sir Henry.

[12] Chanc. Proc. James I. B. 40/70.

[13] Chanc. Proc. James I. B. 17/61.

[14] " A Chorographia," by William Gray, published at Newcastle-upon-Tyne in 1649.

in 1649, it was stated "Many thousand people are employed in this trade of coales; many live by conveying them in waggons and waines to the river Tyne. . . ." The same work said "Some South gentlemen hath, upon great losse of benefit, come into this country to hazard their monies in coale pits. Master Beaumont, a gentleman of great ingenuity and rare parts, adventured into our mines with his £30,000, who brought with him many rare engines not known then in those parts, as the art to boore with iron rodds, to try the deepnesse and thicknesse of the coale; rare engines to draw water out of the pits; waggons with one horse to carry down coales from the pits to the staythes on the river etc.; within a few years he consumed all his money, and rode home upon his light horse." Nicholas Wood[15] remarked that the carts employed in 1602 in conveying coal by road were called "waynes," whereas Beaumont's vehicles were termed "waggons." As ever since that period, Wood says, "The carriages employed upon rail-roads have been designated by the latter name; we may infer, that the "waggon" of Mr. Beaumont was applied upon a rail-way, and that he was the first to introduce them into the north."

Wood's deduction, based on his extensive local knowledge—for he was the viewer at Killingworth—seems reasonable, and is further supported by writers of the seventeenth century, as I hope to show in a few minutes. Before leaving Gray's remarks, however, I think we may extract something further from them by implication. The contrast between the words "waggon" and "wayne" would be unnecessary if the vehicle were designed to run simply on a road of parallel beams, as has often been suggested, or even if permanent way were of the angle-iron or step variety used in later years. A special type of vehicle implied something peculiar to a wagon-way, and I suggest that the "something" was the use of flanged wheels. Admittedly this deduction goes beyond what can be proved from the mere differentiation between the two words for the vehicles, but great strength is given by writers of a few years later, and, of course, cumulative force is the essence of circumstantial evidence.

Wood's remark about the carts employed in 1602 being called "waynes" has resulted in this date being quoted widely as that of the introduction of railways in the North, but it was merely given as an example, and, as we have seen, Beaumont's interest in the Cowpen and Bebside collieries began only in 1605. The records of the port of Blyth[16] show that the first year in which any considerable quantity of coal was recorded as shipped from the river Blyth was 1609, when 21,571 tons were exported. This was therefore the probable year when the wagon-way began to be used. When preparations were being made for celebrating the Railway Centenary at Darlington in 1925, Monsieur Charles Foley suggested[17] that it would be appropriate to commemorate the Frenchmen whose work had contributed towards railway development, and cited Beaumont who established at Newcastle roads of parallel wooden rails. As Huntingdon was a member of a well-known Leicestershire family, his connection with France, if any, must have been remote.

At the same time that Beaumont was introducing wagon-ways from Nottinghamshire into Northumberland, their use was spreading to Shropshire, and we find[18] that in 1606 James Clifford, the Shropshire mining adventurer spent 200 marks (£133 13s. 4d.) in laying "tylting railes . . . which weare made fast to certen of the grownde" along which a "very artificiall engine of timber" conveyed coal through the demesne-lands of the manor of Broseley down to the banks of the Severn. Clifford, the lord of the manor, met with a highly organised opposition to his schemes for preventing freeholders from profiting by the coal under their grounds. While not denying their ownership, he had refused to grant them wayleave across the manorial waste separating their holdings from the river Severn, thinking thus himself to monopolise the trade from Broseley. His tenants challenged him on two counts. First of all they objected to his building cottages on the waste for his "colliers and Minerall men," on the ground that they did not want to have for their neighbours the kind of labourer he hired.[18] Without waiting to get a decision in the courts, the tenants tore down the cottages and the hedges.[19]

In the second place, they denied Clifford's right to sink pits in a pasture called "Calcott" in the possession of one of the tenants, Richard Wilcox. The tenants, though they did not propose to dig here themselves, needed a passage over "Calcott" for the coal from a parcel of their own freeholds, called "Birchleasowe." To gain control of the pasture became, therefore, the aim of both sides. Clifford, by compounding with Wilcox some years before the freeholders had recognised the importance of the coal industry, had been able to sink pits in the pasture.[20] Early in 1606, after having unsuccessfully brought an action in Chancery to oust the lord, a large number of tenants assembled with Wilcox at Calcott colliery, seized various machinery used at the pit, attempted to kill one of Clifford's workmen, and carried off his "tylting railes" along which his wagons ran down to the Severn. They then laid wooden rails of their own to bring coal from "Birchleasowe" but Clifford's men destroyed these and "the gates, highewaies, and the passage of and for the . . . Engin."[21] Henceforth, as quickly as one side laid down rails, they were torn up by the other. In November, 1607, the freeholders are said to have carried out another raid on Calcott colliery. It is not certain how the issue was finally settled, but the main railway interest of the incident is that, through the litigation, we have evidence in the proceedings of the Court of Star Chamber of the use of rails in Shropshire as early as 1606.

An important project for making the King "the sole merchant of the Coales" was presented to Charles I on July 10, 1628. (See Stowe Mss. 326. No. 1). The scheme proposed, *inter alia*:—

> (1) By makinge compitent passages for the waters, that anoye the mynors, or pyonors by makinge one Portable Ryver, from those parts, where the Coales are to be acquired; by makinge Highwaies passable, and reformed Cariages, to convey the Coales to that Ryver. . . .

The proposal was for the Crown to take possession of all the coal mines within the Bishopric of Durham "Uppon remoove of that Bishop" and to develop these mines as a royal enterprise. The "reformed cariages" were doubtless to run on railed wagon-ways. It is scarcely necessary to say that this early suggestion of nationalisation was not proceeded with.

We have a distinct allusion to railways at the northern collieries in a document[22] of 1660, regarding "a bargain and sale from Sir Richard Tempest and others to William

[15] "A Practical Treatise on Rail-Roads, and Interior Communication in General," by Nicholas Wood, Colliery Viewer. 2nd edition, published in 1832.

[16] "The History and Development of the Port of Blyth," by C. E. Baldwin, General Manager and Secretary, Blyth Harbour Commission. Published in 1929.

[17] In the "Echo de Paris," of April 24, 1925.

[18] Star Chamb. Proc. James I, 310/16 (Rich. Wilcox, gent., and others *v.* James Clifford, Esq., and others).

[19] Star Chamb. Proc. James I, 86/18 (Clifford *v.* Rowland Lacon, Esq., Wilcox, and others).

[20] Clifford *v.* Wilcox and others.

[21] Star Chamb. Proc. James I, 310/16 (Rich. Wilcox, gent., and others v. James Clifford, Esq., and others).

[22] Cited by T. J. Taylor, Proc. Arch. Inst., Newcastle, 1852, vol. I, p. 180.

Carr and others, of ten keels or lighters, and a quarter part of the wood or timber laid upon trenches, bridges, and waggon-ways or unlaid upon the same." Other evidence of the existence of wagon-ways about this time in the Stella and Ryton district appears to be afforded by the information obtained in connection with a law-suit of 1665 concerning Crawcrook colliery. The wagons used here are stated to have carried fifteen bolls each, equal to about 33½ cwt., or two wain-loads, a size of vehicle which almost certainly must have been run on a wagon-way.

A Counsel's opinion of 1763 is the next document to assist us. It is an opinion upon a conveyance dated 1672 relating to the South Gosforth and Coxlodge collieries, and says, *inter alia*, " some short time before this conveyance a new method was invented for carrying coals to the river in large machines called waggons made to run on frames of timber fixed in the ground for that purpose and since called a waggon-way which frames must of necessity lye very near, if not altogether upon a level from the colliery to the river and therefore wherever there are any hills or vales between the colliery and the river and the same cannot be avoided, it is necessary in order to the laying such waggon ways, then to make cutts through the hills or level the same, and to raise or fill up the vales so that such waggon way may lye upon a level as near as possible." By this time, therefore, the construction of wagon-ways in the neighbourhood of the Tyne was treated as an engineering work of some importance. There is no suggestion here of the theory which has often been advanced that wagon-ways were evolved by a process of filling with logs the ruts in badly made roads. Moreover, such ways are described as a new method invented some short time before, which is scarcely the phrase a legal man would apply to the rough and ready expedient of repairing deeply-rutted roads with baulks of timber. The one objection to this counsel's opinion as evidence is that although the conveyance in question was made in 1672, the opinion was given ninety years later.

We have, however, very valuable evidence of the position in 1676 in Roger North's account[23] of his brother's experiences when he went on circuit to Newcastle. According to that writer: " Some of the aldermen related strange stories of their coal works. One related to wayleaves: When men have pieces of ground between the colliery and the river they sell leave to lead coals over their ground and so dear that the owner of a rood of ground will expect £20 per annum for this leave. The manner of the carriage is by laying rails of timber from the colliery down to the river, exactly streight and parallel; and bulky carts are made with four rowlets fitting these rails; whereby the carriage is so easy that one horse will draw down four or five chaldron of coals, and it is an immense benefit to the coal merchants."

Here is the clearest evidence of special vehicles for use on the rails, and, moreover, a statement of the peculiar feature of their construction, namely, that they were equipped with rollers fitting the rails. The probabilities are in favour of a wide wooden wheel running on the rail, with a narrow wheel of larger diameter fixed inside to act as a flange. The remark that carriage was easy seems to preclude a roller projecting over both sides of the rail as wear would rapidly make such an arrangement very much the reverse of easy in running.

Daniel Defoe wrote[24] early in the eighteenth century " They (coals) are then loaded . . . into a great machine, called a Waggon, which by the means of an artificial road, called a Waggon-way, goes with the help of but one horse, and carries two Chaldron or more at a time; and this sometimes three or four miles to the nearest River or Water-carriage they come at; and there they are either thrown into or from a great store-house, called a Stethe . . ."

There can be little doubt that during the seventeenth century the wagon-way was developed on Tyneside more extensively than elsewhere, and, in fact, it was often called[25] a " Newcastle road." Before the end of the century the use of wagon-ways had spread to the neighbourhood of the river Wear, where the first line was laid in 1693 by Thomas Allan who " amassed a large fortune in the collieries and purchased estates, a part of which still retains the name Allan's Flatts near Chester-le-Street."[26]

The subject of wayleaves cannot be ignored, for the exactions of landlords in the matter of heavy wayleave rents impeded the progress of rail transport. Roger North's remark about the high prices asked was no isolated statement. As mines adjacent to the river (naturally the earliest to be worked) became exhausted, coal-owners found it necessary to sink shafts further inland; in 1689 it was stated[27] that " the coal-pits nearest the water are almost quite exhausted and decayed." Railways thus became a necessity rather than merely a convenience, and coalowners were compelled to make the best arrangements they could with intervening landlords for rights of passage between the pits and the staiths. Towards the end of the seventeenth century, complaints were voiced frequently,[28] and in 1696 it was even suggested that Parliament should regulate wayleaves, as unrestricted charges were imperilling the inland movement from the Tyne.

In 1671 Sir Thomas Lyddell laid a wagon-way from his Ravensworth (or Ravenswath) colliery to the Tyne at Dunston (or Dunstal) which was the first section of an extensive system of wagon-ways to which reference will be made later. Another early wagon-way that came into the group was one laid in 1712 over Tanfield Moor by Sir John Clavering and Thomas Brumell from their Lintz and Buck's Nook collieries. Two years later George Pitt used this line when he opened out the Tanfield coalfield. Tomlinson records[29] that Pitt came into conflict with William Davison of Beamish, the lord of the manor, who demanded a wayleave rent on the ground that liberty of passage enjoyed by Pitt was confined to carts and wains and did not include wagons running on rails. As Pitt was a member of Parliament the matter was allowed to remain in abeyance, but in 1719 Dame Jane Clavering, widow of Sir John Clavering, who had died in 1714, purchased for £4,000 Davison's rights in Tanfield Moor with the object of securing control of the wayleaves. The matter was referred in 1721 to the Court of Chancery, and ultimately decided[30] in favour of Lady Clavering. By an indenture, dated April 26, 1731, between Dame Jane Clavering and

[23] " Life of the Right Honourable Francis North, Baron of Guilford, Lord Keeper of the Great Seal under King Charles II and King James II." Published in London in 1742.

[24] " The Complete English Tradesman," 1726. Vol. II, Part II.

[25] " Archæology of the Coal Trade," by T. J. Taylor; and " The Coal View and Engine Builders' Practical Companion," by John Curr, of Sheffield, 1797.

[26] William Hutchinson's " History and Antiquities of the County Palatine of Durham," 1794; quoted by John Sykes in " Local Records or Historical Register " in 1833, and by Moses Aaron Richardson in " Local Historian's Table Book."

[27] " Reasons offered to Parliament for the not laying of any further imposition upon coals imported to London," 1689.

[28] See the " Records of the Newcastle Hostmen's Company " regarding a petition dated February 20, 1696, that Parliament should regulate wayleaves; also " An Inquiry into the Reasons of the Advance of the Price of Coals," 1739.

[29] " The North Eastern Railway, its Rise and Development," by William Weaver Tomlinson.

[30] Pitt *v.* Clavering, " Chancery Proceedings," May, 1721.

George Pitt, a right of wayleave from collieries in the Tanfield district to the rivers Tyne or Derwent was granted for 500 years, on payment of 2s. 6d. for every ton of coals carried along the wagon-ways.[31]

Incidentally, this Chancery case[32] gives a good description of permanent way of the period, in the following terms: "For the making of waggon-ways the ground must be made as level as possible, without narrow turnings, and pieces of hard timber or wood called sleepers must be fixed in the ground, and raised some inches from the ground, for the wheels of the waggons to run on, and can be used only by waggons and not by carts." Here again we have the point brought out that special vehicles were required for use on the rail, and the cumulative force of these references by different writers and in a variety of circumstances leaves little doubt that special flanged wheels were used on wagon-ways from their introduction into this country.

[31] Fordyce's "Coal and Iron."

[32] Pitt *v.* Clavering, Plea and Demurrer of Dame Jane Clavering, October 12, 1721.

LOCOMOTIVE DEVELOPMENT IN FRANCE

New 4-6-4 express designs worked out by the O.C.E.M.

ON page 223 of THE RAILWAY GAZETTE of February 5, 1937, reference was made to the fact that the French railways had produced no new locomotive designs for main line express service for some years, that, as a consequence, the proposal of the Nord to build eight new 4-6-4, or Hudson, type locomotives was of special interest. The designs have been worked out by the O.C.E.M. as a result of a mission sent to America in 1934 by the French railways. The adoption of the 4-6-4 wheel arrangement at this juncture by the Nord does not constitute anything new, for the reason that as far back as the year 1912, this company built two experimental 4-6-4 type engines designed by Monsieur Asselin, who was Chief Mechanical Engineer at that time, the engines being characterised as the largest and most powerful then employed in express passenger service on any European railway. They were four-cylinder compounds and their design embodied many interesting features; they were illustrated and described in some detail in THE RAILWAY GAZETTE of June 7, 1912, and one of them, cut sectionally to show at the forthcoming Paris Exhibition, was illustrated in our issue of March 19. Prior to this, the same railway company had experimented with a four-cylinder compound locomotive of the 4-4-4 type built by Schneider & Co., of Creusot, and fitted with a water-tube firebox of the wide pattern resting on top of the frames, and a drawing and a few particulars of this engine appeared on page 537 of THE RAILWAY GAZETTE dated December 6, 1907. This 4-4-4 engine, No. 2.741, was subsequently converted into a 4-6-0 and is still in express train service as No. 3.999. It is interesting as being the only 4-6-0 on the Nord with driving wheels larger than 6 ft. diameter.

The new engines now planned by the O.C.E.M. in collaboration with the firm of Schneider & Co., have two separate cylinder arrangements. One has three single-expansion cylinders in line, all driving the centre pair of coupled wheels, the leading axle being cranked to provide clearance for the inside connecting rod. With this arrangement, the maximum theoretical tractive effort is 30,600 kg. (67,460 lb.). The other is a four-cylinder compound with high-pressure cylinders between and low-pressure ones outside the frames. In this arrangement the drive is divided, the outside (l.p.) cylinders driving the middle pair of coupled wheels, and the inside (h.p.) ones the crank axle of the leading pair; with this arrangement the maximum theoretical tractive effort is 24,800 kg. (54,675 lb.). In both cases the Dabeg R.C. poppet valve system is employed for steam distribution to the cylinders, and the application of this mechanism is shown in the accompanying drawing of both types of engines, compound and non-compound.

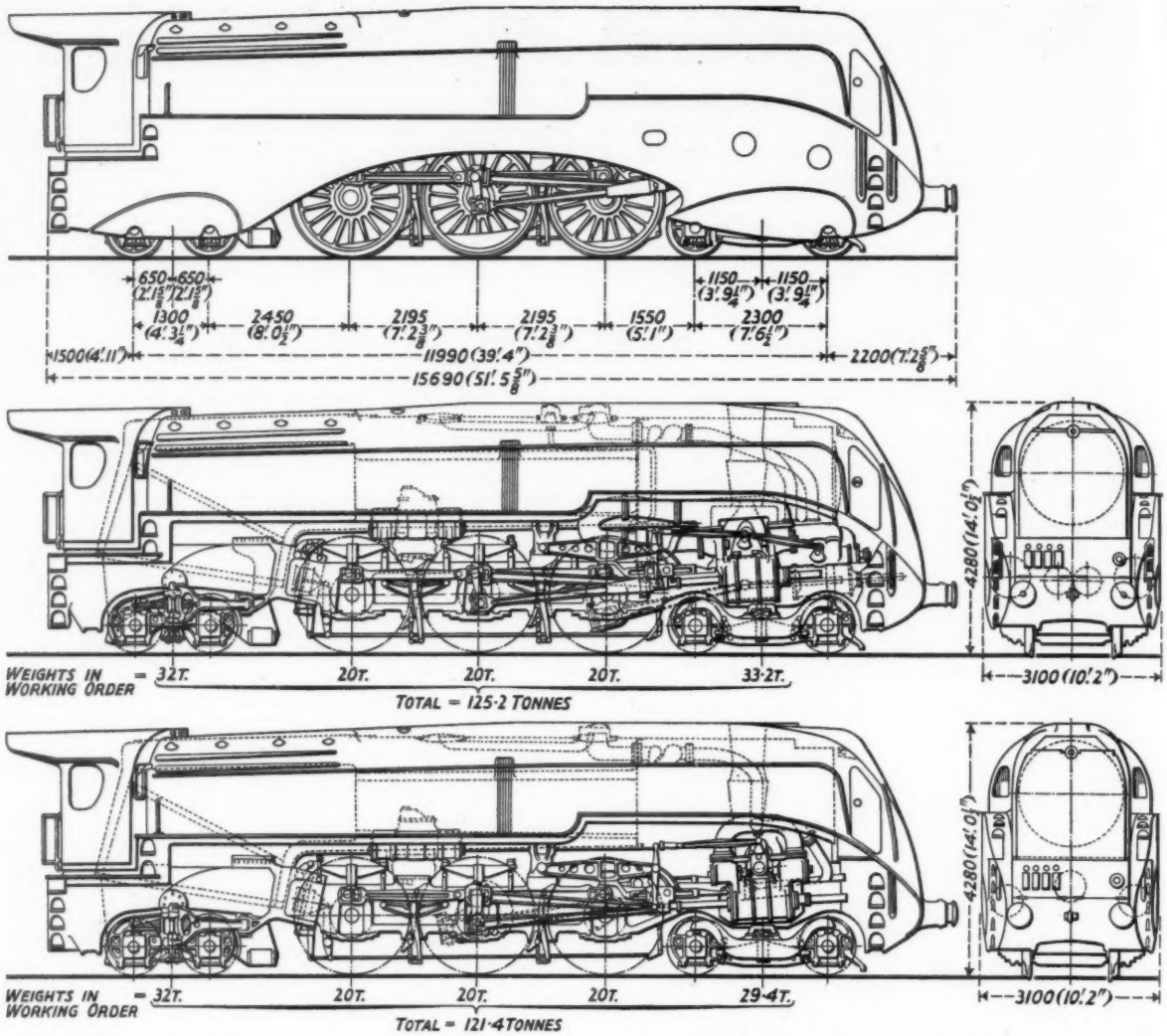
The dimensions of the boiler, grate, wheels and certain other details are the same in both cases. There is naturally a slight difference in the weight of the respective engines in working order; that of the three-cylinder design being calculated at 113 metric tons (111 tons 4 cwt.) and of the compound 116 metric tons (114 tons 3 cwt.). The wheel spacing and total wheelbase of each engine are, as the drawings show, the same, and indeed the only specific difference between the two designs is to be found in the number of cylinders, the principle on which they operate, and the arrangement of the driving mechanism.

The leading particulars of each locomotive are as follow:—

	(A) Single-expansion. (Three high-pressure cylinders in line)	(B) Compound. (Two high and two low-pressure cylinders)
Cylinders, diam. h.p.	540 mm. (21¼ in.)	480 mm. (18⅞ in.)
,, ,, l.p.	—	680 mm. (26¾ in.)
,, stroke	700 mm. (27 9/16 in.)	700 mm. (27 9/16 in.)
Coupled wheels, diam.	2,000 mm. (6 ft. 6¾ in.)	
Bogie wheels, diam.	970 mm. (3 ft. 2¼ in.)	
Bissel wheels, diam.	970 mm. (3 ft. 2¼ in.)	
Boiler working pressure	20 hpz. (290 lb. per sq. in.)	
Heating surface—		
Tubes and flues	168·0 sq. m. (1,807·7 sq.ft.)	
Firebox	22·5 sq. m. (242·1 sq. ft.)	
Superheater	75·0 sq. m. (807·0 sq. ft.)	
Total	265·5 sq. m. (2,856·8 sq. ft.)	
Grate area	5·23 sq. m. (56·27 sq. ft.)	
Wheelbase, rigid	4,390 mm. (14 ft. 4⅞ in.)	
,, total engine	11,990 mm. (39 ft. 4⅛ in.)	
Weight of engine in working order	113 m. tons (111 tons 4 cwt.)	116 m. tons (114 tons 3 cwt.)
Adhesion weight	60 m. tons (59 tons 1 cwt.)	60 m. tons (59 tons 1 cwt.)
Maximum theoretical tractive effort	30,600 kg. (67,460 lb.)	24,800 kg. (54,675 lb.)

The grate is 3,000 mm. (9 ft. 10⅛ in.) in length and 1,745 mm. (5 ft. 8⅛ in.) in width. There are 131 firetubes of 50/55 mm. (1·968/2·165 in.) diameter, and 33 flues of 135/143 mm. (5·315/5·630 in.) diameter, with 33 superheater tubes 31/38 mm. (1·220/1·496 in.) in diameter. The distance between tube plates is 4,850 mm. (15 ft. 10⅛ in.), and the cross-sectional area of passage for gas flow is 0·5797 sq. metres (6·24 sq. ft.). The water capacity of the boiler is 9 cu. metres (317·8 cu. ft. or 1,980 gallons), and the steam space is 5 cu. metres (176·5 cu. ft.).

The maximum output of the boiler corresponds to 3,600 metric i.h.p. (3,553 i.h.p.). The locomotives are capable of running easily on curves of 100 metres (328 ft.) radius. Westinghouse brake is fitted and the coefficient of braking is 60 per cent. for the leading bogie and 160 per cent. for the coupled wheels and bissel. An A.C.F.I.



Two new O.C.E.M. designs for streamlined 4-6-4 express locomotives to be built for the Northern Railway of France. The top drawing is an elevation; the middle one is a section of the four-cylinder compound; and the bottom, the three-cylinder simple

feed heater is provided; the superheater is of the Houlet type; and Leach sanding gear is fitted. As shown by the drawing, the locomotive is streamlined.

The performance of these locomotives will be awaited with great interest, not only on account of their high power and the probability that a fresh and higher standard of performance will be established, but also because of the useful comparisons which will be made possible between the work of the locomotives with the different cylinder arrangements.

The L.N.E.R. "City of Leeds," an Interesting Railway Steamer

An interesting railway steamer, the *City of Leeds*, owned by the L.N.E.R., has been sold to Hughes, Bolckow, the Blyth shipbreakers. Built by Earle's Yard at Hull for the old Great Central Railway Company in 1903, the *City of Leeds*, with a sister ship, the *City of Bradford*, were far and away the biggest ships of the fleet. They were the first steel ships to be built for the railway, and the *City of Leeds* had a single screw with a gross tonnage of 1,341. Machinery consisted of triple-expansion engines supplied with steam from two single-ended boilers giving a comfortable 14 knots. When built the vessel aroused considerable attention in marine engineering circles because the new boiler works of Earle's yard had permitted the shells of the boilers to be made in only two pieces, reducing joints and rivets to a minimum. The *City of Leeds* was designed for the regular passenger and cargo service between Grimsby and the Continent. The ship had a deadweight capacity of 1,193 and accommodation for 60 first class passengers and over 250 emigrants, of which there were a considerable number in those days. She exceeded the contract speed very comfortably when tried, and for more than 10 years was a successful packet. When war broke out the vessel was one of the unlucky ships which were detained by the German authorities at Hamburg. The *City of Leeds* was used as a mine store only, so that the ship was still in good condition, although sadly neglected, when returned to the Tyne at the end of the war.

FLAT-BOTTOM TRACK ON L.M.S.R. MAIN LINES

AS an experiment, the London Midland & Scottish Railway has recently laid about 5 miles of 110 lb. flat-bottom B.S. rail in main lines. Short lengths were laid with different types of fastening, and, by the kindness of Mr. W. K. Wallace, Chief Civil Engineer, we are enabled to illustrate them herewith. Comparative costs of such short lengths would be no guide for the adoption of flat-bottom track on a large scale, but the lengths are quite sufficient to indicate the relative merits in service of the different types of fastening, and of flat-bottom compared with bull-head track. The gangers maintaining the various trial lengths send in a special weekly return giving in detail the man-hours spent on various jobs in maintaining the road, and a similar return for the trial length of B.S. track which adjoins each section of flat-bottom track. The first of the latter have now been in service a little over six months, and the running over them is distinctly good.

Probably the most interesting of the various types of fastening is the elastic spike (Fig. 3) which is driven into an ordinary round hole bored in the sleeper. The elastic spike is of $\frac{5}{8}$ in. × $\frac{5}{16}$ in. heat-treated spring steel doubled back on itself, giving in effect a $\frac{5}{8}$ in. square section. After initial contact between the end of the swan neck and the foot of the rail, the spike is driven about another $\frac{3}{8}$ in., which is estimated to produce a pressure of 700 to 1,000 lb. on the rail. It is claimed that the spring of the spike head transmits practically all the vertical force under traffic as a lateral reaction on the shank of the spike. This, combined with the high holding power of the square spike in the round hole, prevents any vertical rising of the spike, which remains firmly gripping the foot of the rail as originally driven. The spike can, of course, be withdrawn from the sleeper if necessary by a vertical pull. It is claimed for this type of spike that it minimises movement between the rail and soleplate, and between the soleplate and sleeper, and that while the powerful grip of the spike on the foot of the rail practically prevents relative movement laterally between the rail and the soleplate, thus eliminating creep, resiliency is retained. In the lengths laid for test purposes 24 or 29 sleepers to a 60-ft. rail length have been adopted. A camber of $\frac{1}{32}$ in. is given to the rail seat of the baseplates except where wood packing made from old-felled poplar is used.

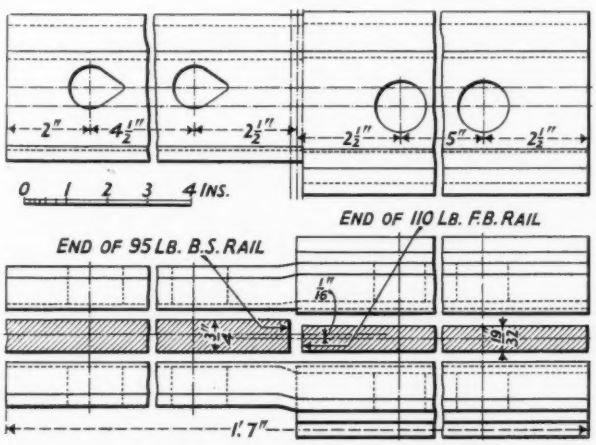


Fig. 1—Junction fishplate for connecting 110-lb. B.S.F.B. rail with 95-lb. R.B.S. B.H. rail

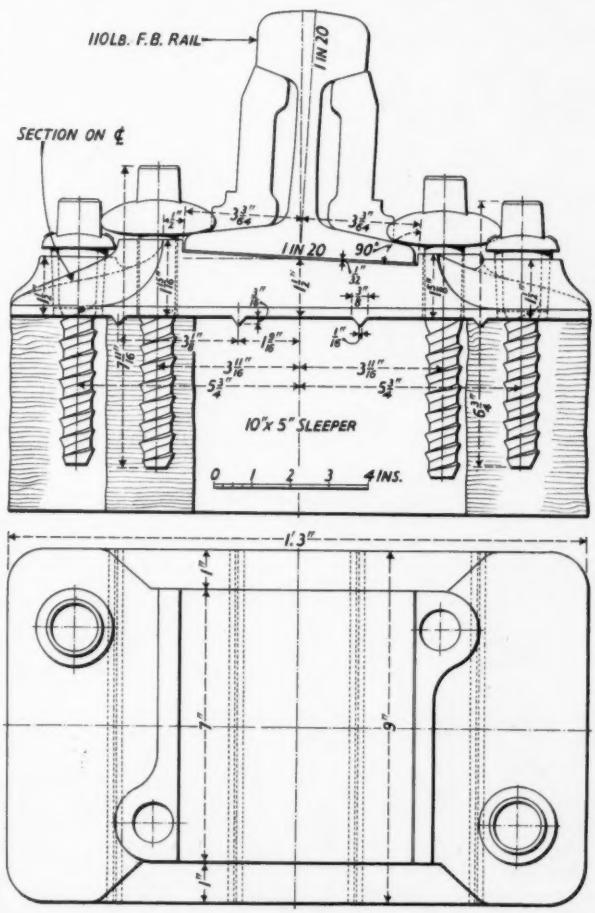


Fig. 2—F.B. track with cast-iron baseplate made by Taylor Brothers, and F.B.M. screw fastening and rail anchors, between Humberstone Road and Syston

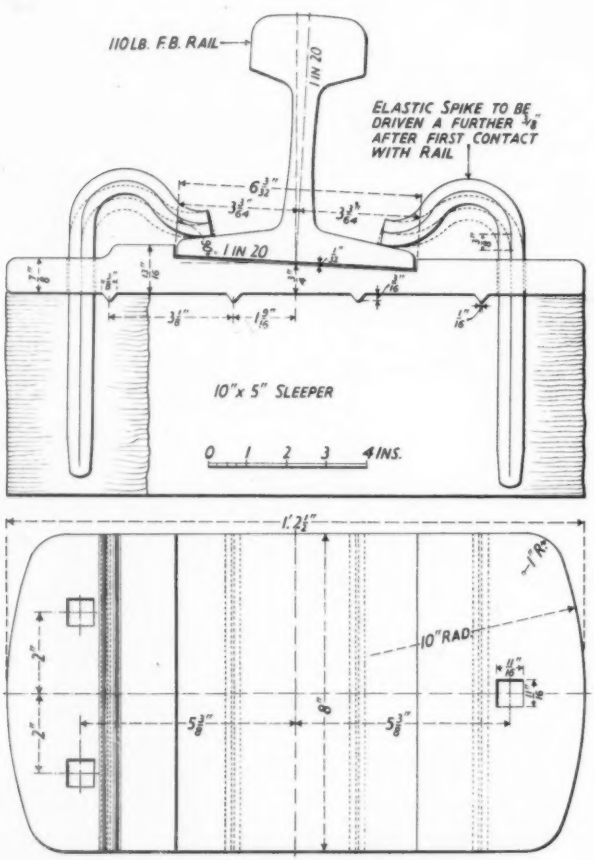


Fig. 3.—F.B. track with baseplate made by Henry Williams, and elastic spike fastening, between Harlington and Leagrave

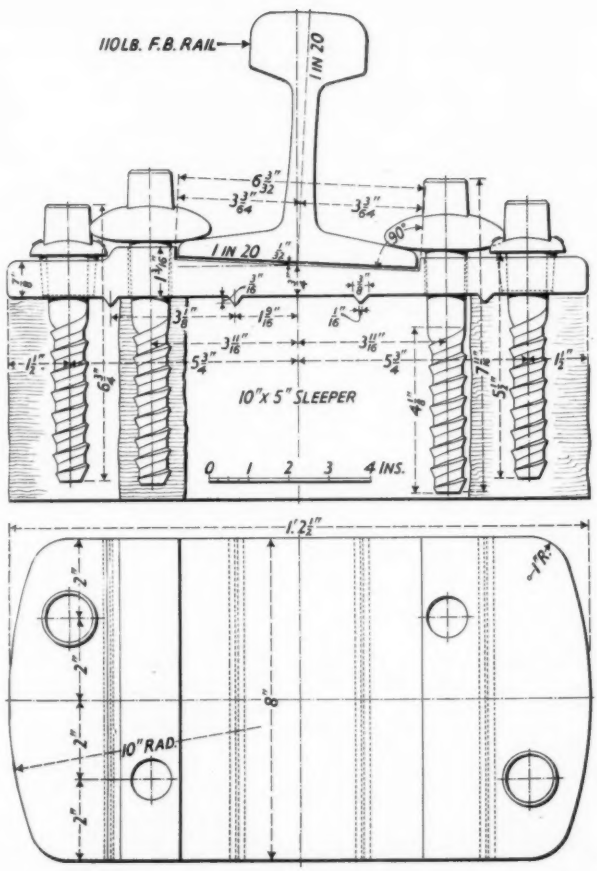
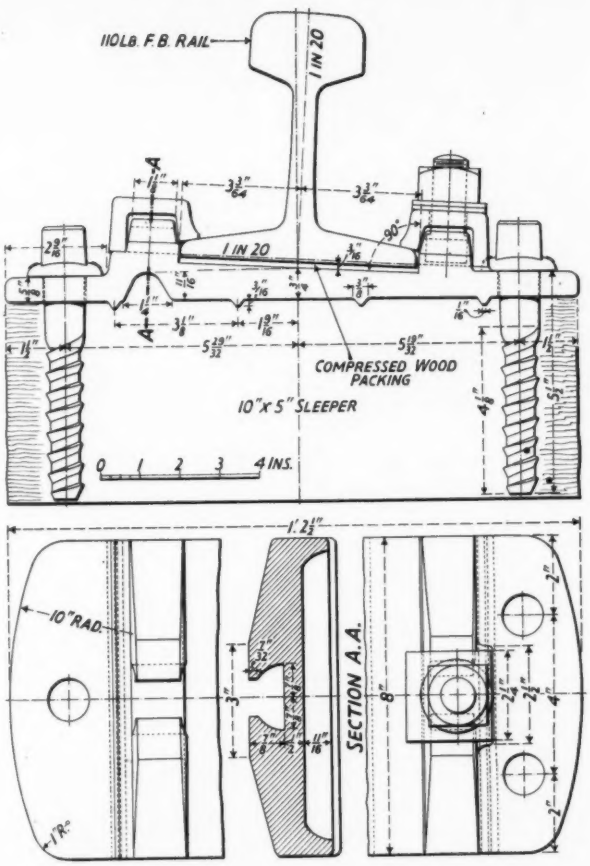


Fig. 4—F.B. track with baseplate made by Henry Williams, and F.B.M. screw fastening and rail anchors, between Harlington and Leagrave

EXPERIMENTAL LENGTHS OF FLAT-BOTTOM TRACK ON



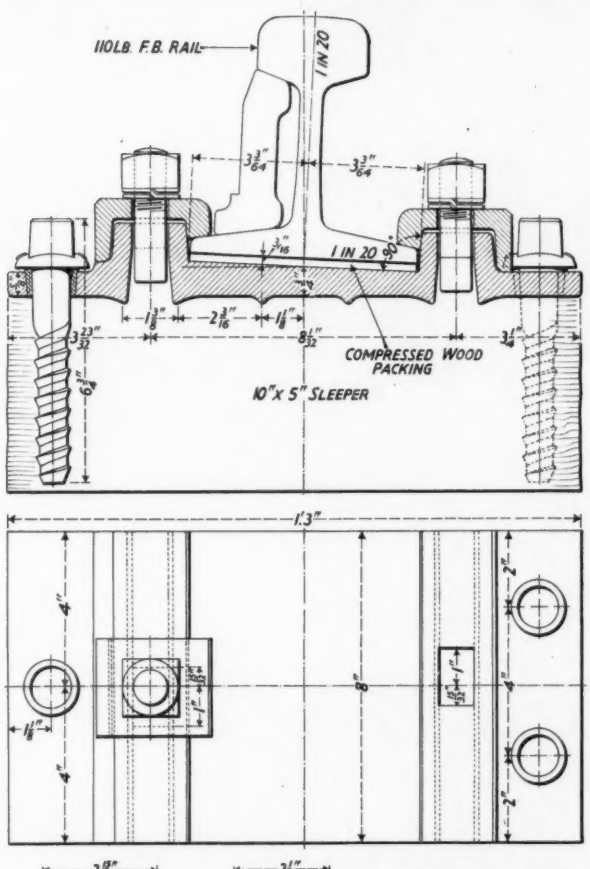


Fig. 5 (above)—F.B. track with clip-type baseplate made by Henry Williams (24 and 29 sleepers per 60-ft. length). Fig. 6 (right)—Ditto but with clip-type baseplate made by Colvilles (24 and 29 sleepers per 60-ft. length). Both are between West Hampstead and Cricklewood. Note wood packing (of old poplar in this case) under rail

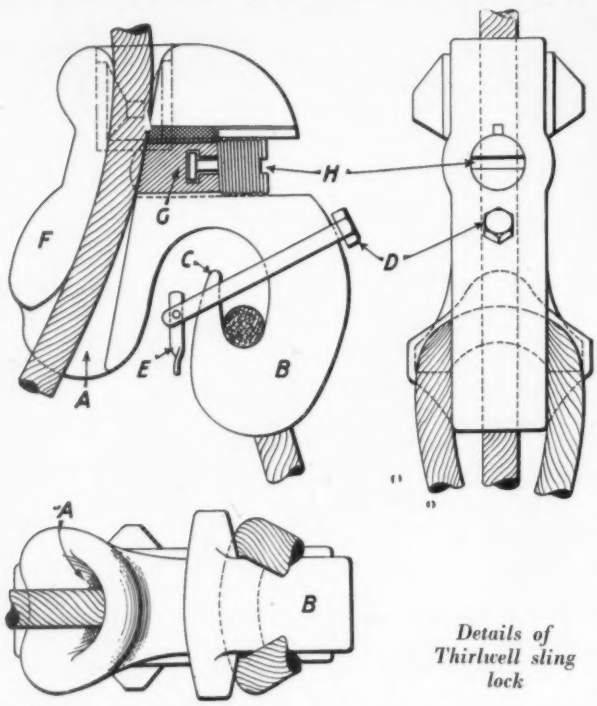
L.M.S.R. MAIN LINES

A SIMPLE AND EFFECTIVE LIFTING DEVICE

Details of the Thirlwell sling lock; adaptable to many railway uses

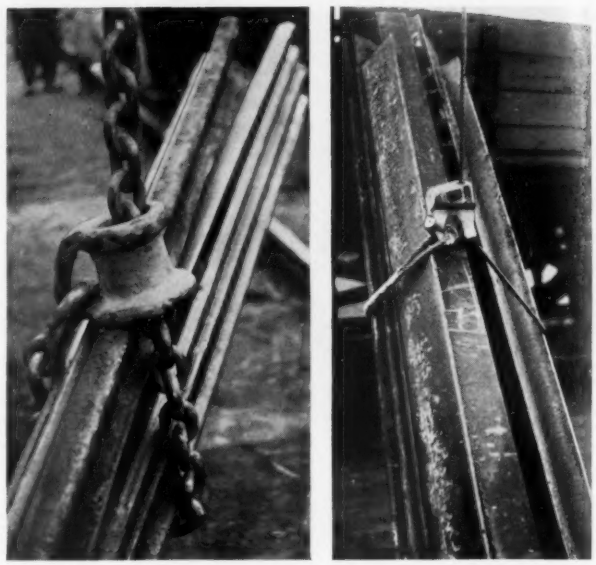
LIFTING devices play a very important part in railway locomotive and carriage and wagon shops, in goods depots and warehouses, docks, and wherever goods and materials have to be transferred from one point to another mainly at different levels. The most simple of all such devices, namely, a rope sling, leaves much to be desired; the rope is subjected to heavy friction leading to rapid wear, and the chance of slipping and other risks attend its use.

With a view to obviating these and other disadvantages there has been introduced a patented device known as the Thirlwell sling lock, the principle of which is illustrated in the accompanying drawings. Below is a longitudinal sectional elevation, in which the rope is shown passing downward from the crane head through the hole *A* and encircling the burden. In the case of a double rope or endless strop, the loop, or in the case of a single rope an eye, is placed over the hook *B* at *C*. To secure this further, and to prevent all possibility of the loop or eye becoming displaced after hooking, there is inserted a pin *D*, which has a short pivoted terminal *E* turned out of alignment by pressure against *F* thus securely linking the rope until release is obtained by re-alignment of the terminal *E*. The pull of the crane and the weight of the load provide tension on to the flat base of the sling, and together serve to grip the burden, which may be further secured by insertion of the bronze plunger *G*, is operated by means of the screw *H*, and actually enables the load to be locked within the rope. This provision is not required for general purposes, but occasions arise where its use is invaluable.



Details of Thirlwell sling lock

The Thirlwell sling lock is an ingenious but simple device, and exceedingly easy to use. It is just as effective with unbalanced as with balanced loads, and removes such difficulties as kinking of the rope and the swinging of the rope relatively to the sling lock. Experience has shown that the device can be fully relied upon for safety, rope economy, and easy handling, and for fitting or tightening round the load automatically; whilst further it is adaptable to the lifting almost any object whether comprised of a solid piece or made up of a number of separate items such as pipes, girders, or planks, which are held securely together in one lift. It can be fixed or freed in a moment from the burden, and not as usual from the crane hook.



Lifting rails and angles by means of Thirlwell sling lock in conjunction with chain (left) and rope (right)

Reference has already been made to the chance of the burden slipping during the lifting operation. With the Thirlwell device, however, such tendency is at once arrested, as a lever action brings the buttresses into action and tightens the sling. The device is made for use with wires ropes in a range offering capacities from ½ ton to 5 tons, and in addition is manufactured in a separate form for use with chain or manilla ropes. In the chain model it is the only device offering a constant factor of safety, enabling the load to be fitted or tightened to the degree of a link, and not link to link as is the usual practice; we are informed that the device is designed to meet the Home Office requirements, and is exhibited in the Home Office Industrial Museum.

Demonstration at Middlesbrough

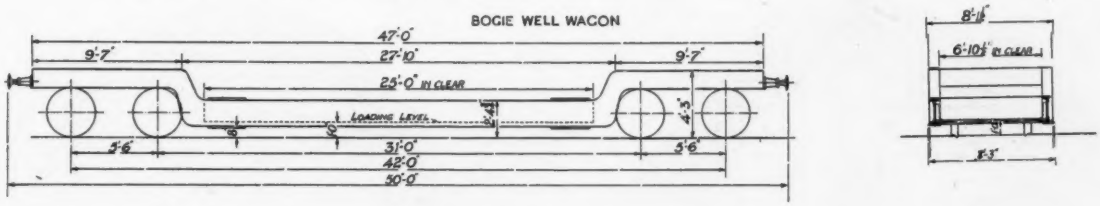
Recently a demonstration of the Thirlwell (patent) sling lock was given at the L.N.E.R. docks at Middlesbrough, and was attended by several of the railway company's officers. The lock was used for various lifts as follows: wire rope sling lock lifting loads of one and two tons; and chain sling locks lifting loads of 2¼ and 3 tons. The materials used by the railway in this demonstration were selected for the purpose and sent from Darlington; they comprised a very comprehensive range of various lifts in steel and iron, and were awkward loads to handle. They were picked up at random, leaving the Thirlwell sling lock to arrange its own bundling or stacking as the crane lifted it from the ground. Many of the loads, if not all

of them, comprised odd lengths, and 50 per cent. of them were made up of materials of different shapes and sizes. Yet they were readily and automatically handled by the sling lock.

It was the same with the setting down of the loads, where, of course, there is always danger for the reason that as soon as the longer units of the load touch the ground they relieve the sling of the weight. At this demonstration, however, all loads were landed as well as lifted with perfect safety, and if necessary an added factor of safety can be achieved with this device by reverting to the double bight before hooking on, either with wire or chain, and making use of the lock provided. The demonstration, in short, very conclusively emphasised the considerable advantage of the Thirlwell device, which is manufactured and supplied by the Thirlwell (Patent) Sling Lock & Eng. Co. Ltd., of Union Chambers, 41, Grainger Street, Newcastle-upon-Tyne.

G.W.R. Vehicles for Exceptional Loads—V

High-capacity bogie wagons for objects of unusual dimensions or weight



Bulky loads weighing up to 35 tons are conveyed by this type of bogie well wagon

A 73-ton stator on a convertible well or side girder wagon for 120-ton loads. As a side girder wagon, it is specially intended for the conveyance of transformers

CORONATION HONOURS

His Majesty the King has been pleased to confer the following honours:—

Viscount

The Right Hon. Sir Robert S. Horne, G.B.E., K.C., LL.D., M.P., Chairman, Great Western Railway Company.

Barons

Sir John Cadman, G.C.M.G., D.Sc., D.Litt., D.Eng., M.Inst.C.E., Director, Great Western Railway Company.

Sir John Davenport Siddeley, C.B.E., J.P., Chairman and Managing Director, Armstrong Siddeley Motors Limited.

Privy Councillors

Col. Sir George Lloyd Courthope, Bt., M.C., T.D., J.P., D.L., M.P., Director, Southern Railway Company.

Knights Bachelor

Mr. Henry Chapman, C.B.E., Resident Director and General Manager of the Rhodesian Railway Companies.

Mr. Thomas Howard Elderton, Chairman, Calcutta Port Trust.

Mr. Vivian E. D. Jarrad, Agent, Bengal-Nagpur Railway.

Mr. Joshua Scholefield, K.C., Chairman of the Railway Assessment Authority; President, London Passenger Transport Arbitration Tribunal.

Mr. George W. A. Trimmer, M.Inst.C.E., M.I.Mech.E., M.Inst.T. Chairman and General Manager of the Singapore and Penang Harbour Boards. Straits Settlements.

Mr. William Valentine Wood, Senior Vice-President of the Executive of the London Midland and Scottish Railway Company.

Royal Victorian Chain

Colonel the Right Hon. Clive, Baron Wigram, G.C.B., G.C.V.O., C.S.I., a Director, London Midland & Scottish Railway Company.

K.C.I.E.

Sir Thomas Guthrie Russell, Chief Commissioner of Railways, India.

C.I.E.

Mr. John James Crosbie Paterson, Locomotive and Carriage Superintendent, Bombay, Baroda & Central India Railway.

Imperial Service Order

Mr. Charles Buxton Anderson, M.Inst.C.E., M.I.E. (Aust.), Railways Commissioner for the State of South Australia.

K.B.E. (Civil Division)

Colonel John Chappell Ward, C.M.G., C.I.E., D.S.O., M.B.E., Director of the Port of Basra and Director of Navigation, Iraqi Government.

C.B.E. (Civil Division)

Mr. Charles William Reeve, Chairman and Managing Director of the Associated Equipment Co. Ltd., for services to the Air Ministry.

Mr. Robert Hill Tolerton, D.S.O., M.C., Assistant Secretary, Roads Department, Ministry of Transport.

O.B.E. (Civil Division)

Mr. William Cecil Clemens, Senior Engineering Inspector, Roads Department, Ministry of Transport.

Mr. Eustace James Missenden, M.B.E., Traffic Manager, Southern Railway Company.

Mr. Charles Parker, M.B.E., Assistant for Passenger Services to the Chief Operating Manager, London Midland and Scottish Railway Company.

(*Continued on page* 949)

Elliott] *[& Fry*

The Right Hon. Sir Robert S. Horne, G.B.E., K.C., LL.D., M.P.,

Chairman, Great Western Railway Company, who becomes a Viscount

Mr. W. V. Wood,

Vice-President, Finance and Service Departments, London Midland & Scottish Railway, who receives a Knighthood

RAILWAY NEWS SECTION

PERSONAL

The late Mr. Alex. Wilson, O.B.E., whose sudden death on May 5 we reported last week, began his railway career in the Goods Department of the Caledonian Railway, but came to England in 1889 as Secretary of the Scarborough & Whitby Railway. On the absorption of that line by the North Eastern Railway in April, 1898, he was appointed an Assistant in the General Manager's Office, under Sir George Gibb. In 1914, in addition to his other duties, he was appointed Secretary of the Hull Joint Dock Committee. In 1918 the distinction of O.B.E. was conferred upon him, in recognition of special services rendered during the war. In the war period, in fact, Mr. Wilson was largely responsible for carrying on the work of the N.E.R. General Manager's office during Sir Alexander Butterworth's frequent absences in London. In January, 1920, Mr. Wilson was appointed Assistant General Manager, and in February, 1922, became Chief Goods Manager, N.E.R., in succession to Mr. (now Sir) Ralph Wedgwood. After the formation of the L.N.E.R. group, Mr. Wilson was made Divisional General Manager, North-Eastern Area, in 1922, and was appointed Divisional General Manager, Southern Area, in June, 1924. He retired from that post in June, 1929. A report of the funeral will be found on page 949.

The late Mr. Alex. Wilson, O.B.E.,
Divisional General Manager, Southern Area, L.N.E.R., 1924-1929

Mr. C. E. Spurgeon, M.I.Mech.E.,
Appointed Deputy General Manager, Egyptian State Railways

Mr. E. W. I. Arkle,
Appointed Assistant Goods Manager, North-Eastern Area, L.N.E.R.

We regret to announce the death, on May 1, of Mr. R. C. H. Barnard, sometime Deputy Chief Engineer, Great Indian Peninsula Railway, aged 74.

Mr. C. E. Spurgeon, M.I.Mech.E., whose appointment as Deputy General Manager, Egyptian State Railways, was announced last week, was born in 1879, and gained his early locomotive and engineering experience at Swindon, G.W.R., and University College, London. In 1904 he was appointed an Assistant Locomotive Superintendent on the North Western Railway, India. He was promoted to District Locomotive Superintendent in 1911 and, after varied experience in the design, layout, and construction of locomotive repair shops, and oil-fired locomotives, and in charge of various districts, was promoted to officiate as Deputy Chief Mechanical Engineer. In 1922 he was put in charge of the workshops and later was appointed Superintendent, Mechanical Workshops, N.W.R. In 1928 Mr. Spurgeon was appointed to officiate as Chief Mechanical Engineer of that railway, was confirmed in this post in 1929, and retired from service in India with this rank in May, 1934. His appointment as Chief Mechanical Engineer, Egyptian State Railways, from which he is now promoted, took place in November of the same year.

Mr. E. W. I. Arkle, whose appointment as Assistant Goods Manager, North-Eastern Area, L.N.E.R., was announced on May 7 was born in Birkenhead, and educated at Marlborough, and Exeter College, Oxford. He joined the Scottish Area of the L.N.E.R. in 1923, but was transferred to the North Eastern Area in 1925, and spent the next two years training in the Sunderland, Darlington, and West Hartlepool Districts. During 1927-28 he was engaged in the Chief General Manager's Office, at King's Cross, in connection with mineral transport and industrial agency, and during the latter year also in the Goods Manager's Office, York, in connection with container traffic and the extension of the North Eastern Area motor lorry fleet. Mr. Arkle was appointed head of the works and docks section of the District Goods Manager's Office at Hull in 1929, but from September in that year onwards he spent a year on the German State Railway, studying all branches of work in various parts of the country. Thereafter he was employed in the traffic and statistical section of the Divisional General Manager's Office, York, until in July, 1933, he was promoted to be Assistant District Goods Manager at Newcastle. In October, 1934, he was appointed Assistant District Superintendent at Newcastle, becoming District Passenger Manager, Newcastle, in June, 1936, from which position he is now promoted.

Professor W. L. Bragg, O.B.E., F.R.S., at present Langworthy Professor of Physics in the University of Manchester, is to assume duty next autumn as Director of the National Physical Laboratory.

The late Mr. David Hughes, who drove Queen Victoria's funeral train from Paddington to Windsor on February 2, 1901, and was driver of the Royal train on the G.W.R. during the reigns of Queen Victoria and Edward VII, left estate valued at £778 (net personalty £755). Mr. Hughes died on

Royal Interest in Home and Empire Locomotives

Above: The King inspecting the cab of a locomotive for the South African Railways at the Hyde Park locomotive works, Glasgow, in 1919

Left: The King and Queen on the footplate of a "Lord Nelson" locomotive during their visit in 1926 *to the Ashford works, Southern Railway*

Below: Group including the King at Hyde Park works of the North British Locomotive Co. Ltd. in 1919

January 1 at the age of 93. He retired in 1906, after 42 years' service with the company.

THE LATE MR. ALEXANDER WILSON

The funeral of the late Mr. Alexander Wilson, whose sudden death was recorded last week, and whose biography appears on page 947 of this issue, took place at Golders Green Crematorium last Saturday. Among those attending the service were :—

Sir Ralph Wedgwood, Chief General Manager, L.N.E.R., Lady Wedgwood ; Sir Alexander Butterworth, former General Manager, North Eastern Railway ; Mr. C. H. Newton, Divisional General Manager, Southern Area, L.N.E.R. ; Mr. C. J. Selway, Passenger Manager, Southern Area, L.N.E.R. ; Mr. V. M. Barrington Ward, Superintendent, Western Section, Southern Area, L.N.E.R. ; Mr. C. J. Brown, late Engineer, Southern Area, L.N.E.R. ; Mr. S. L. Murgatroyd, late Permanent Way Engineer, Southern Area, L.N.E.R. ; Mr. J. A. Kay, Editor, THE RAILWAY GAZETTE ; Mr. H. C. Walton, General Secretary, Railway Benevolent Institution ; Mr. J. F. Gee, former Chief Accountant, L.M.S.R. ; Mr. W. A. Jepson, late Permanent Member, Railway Rates Tribunal.

By the courtesy of the Editor of the *London & North Eastern Railway Magazine*, we are enabled to publish the following appreciation of Mr. Wilson, which will appear in the next issue of that journal :—

" On May 5 the sad news came to King's Cross that Mr. Alexander Wilson had passed away in his sleep. An unexpected end had been put to a full and active life. Since he retired from the post of Divisional General Manager (Southern Area), Mr. Wilson had taken a great interest in the work of the Railway Benevolent Institution, and he was also Chairman of the House Committee at the Victoria Park Hospital, of which Sir Alexander Kaye Butterworth is Deputy Chairman. He was keen on golf to the last, and once a year he used to take a motoring and fishing holiday in the Highlands. For, as an old friend said last month, ' A.W. was a straight and trusty Scot,' with all the energy of his race. It is difficult to believe that his brisk step and incisive speech will never again be heard in the corridors of the headquarter offices."

Mr. Herbert Clark has relinquished his responsibilities as Managing Director of Tangyes Limited, of Birmingham, as from May 7.

We are asked by Mr. W. G. Edmonds to correct our notice last week regarding his promotion to be Second Lieutenant, Supplementary Reserve of Officers, Royal Engineers, Transportation, in which his name appeared wrongly as " Evans."

Mr. T. E. Brain, who, as recorded in our issue of April 2, was appointed Assistant Secretary of the Southern Railway Company as from April 1, has also been appointed Secretary of the North Devon & Cornwall Light Railway (the Halwill Junction—Torrington branch, worked by the Southern) as from May 1.

The Secretary of State for the Colonies has appointed Major °C. R. Turner, Running Superintendent, Gold Coast Government Railway and Takoradi Harbour, to be Chief Mechanical Engineer to that administration.

Captain Hugh Vivian, M.I.Mech.E., M.I.M.M., has been elected Chairman of the board of directors of Beyer, Peacock & Co. Ltd., and its subsidiary company, the Richard Garrett Engineering Works Limited. Capt. Vivian is a director of the Metropolitan-Vickers Electrical Co. Ltd., the Briton Ferry Steel Co. Ltd., the Indian Copper Corporation Limited, Vivian & Sons Ltd., etc.

We regret to record the death on May 5 of Mr. George Kick, Chief Cashier, London Midland & Scottish Railway. Mr. Kick became Chief Cashier of the London & North Western Railway on November 1, 1920, and was appointed Chief Cashier of the London Midland & Scottish group on its formation in 1923.

It is with great regret that we learn of the death on May 12, at the age of 81, of Sir Henry Birchenough. Sir Henry was President of the British South Africa Company, and Chairman of the Beira Railway Company, the Mashonaland Railway Company, Rhodesia Railways Limited, the Rhodesia Railways Trust, and the Shabani Railway Company.

BURMA RAILWAY BOARD

In THE RAILWAY GAZETTE of April 2 we published an editorial outlining the changes connected with the separation of Burma from India, and the establishment of an autonomous railway system in the former country under a newly-constituted Railway Board. We are now officially informed that the composition of this board is as follows :—

Official Members

Mr. J. E. M. Rowland, Chief Railway Commissioner and formerly Agent, Burma Railways ; President.

Mr. H. O. Reynolds, I.C.S., Financial Commissioner to the Government of Burma ; Financial Member.

Mr. J. H. Wise, I.C.S., Secretary to the Government of Burma, Commerce and Industries Department (Commerce Branch) ; Secretary to the Government in the Department dealing with railways.

Non-official Members

Mr. H. S. Bowlby (of the Burma Oil Co. Ltd.), nominated by the Burma Chamber of Commerce ;

U Hla Bu (engineer and contractor), nominated by the Burmese Chamber of Commerce ;

Mr. Khoo Sain Kho, nominated by the Chinese Chamber of Commerce ; and

Mr. S. A. S. Tyabji, nominated by the Burma Indian Chamber of Commerce.

Non-official Members appointed by H.E. the Governor

U San Hla Baw, and

U Ba Thaw.

The Secretary to the board is Mr. C. P. Brewitt, M.B.E., Deputy Railway Commissioner and formerly Deputy Agent, Burma Railways.

We greatly regret to record the death on May 11 of Sir George H. Sutherland, who, until his resignation owing to ill-health in June of last year, was a Director of the Bengal & North Western Railway Company.

L.M.S.R. APPOINTMENTS

The following appointments have been approved by the directors of the London Midland and Scottish Railway :—

Mr. S. W. Spendlove, Assistant (Telegraphs), Manchester, to be Divisional Signal and Telegraph Engineer, Manchester.

Mr. K. C. Marrian, Resident Engineer, Engineering Department, Liverpool (Central) to be District Engineer, Manchester (Exchange).

Mr. M. Harbottle, Draughtsman, Engineering Department, Edge Hill, to be Canal Assistant, Crewe.

Mr. R. L. Millward, Outdoor Assistant to Divisional Superintendent of Operation, Crewe, to be Assistant Divisional Controller (Freight Services), Office of Divisional Superintendent of Operation (Crewe).

Mr. A. M. Harding, Show Canvasser, Chief Commercial Manager's Office, Euston, to be Chief Passenger & Goods Canvasser, Chief Commercial Manager's Office, Euston.

Mr. W. H. Tinsley, Agent, Barcelona (Spain), to be Agent, Covent Garden.

Mr. A. Fraser, Assistant Stationmaster, Glasgow (Central) to be Stationmaster, Perth (General).

Coronation Honours

(*Continued from page* 946)

M.B.E.

Mr. Julian Ralph Bulmer, Commodore Captain, Holyhead-Kingstown Steamship Services, London Midland & Scottish Railway Company.

Mr. William Archibald Ellison, Assistant Engineer in charge of Agency Services, Ministry of Transport.

Mr. Walter Enves, Stationmaster, Victoria, Southern Railway Company.

Mr. William Francis Joyce, Chief Engineer, Newfoundland Railway.

Mr. Arthur Edward Ritchen, Station Superintendent, East Indian Railway, Howrah.

Mr. George Robertson, Stationmaster, Edinburgh (Waverley), London & North Eastern Railway Company.

British Empire Medal, Civil Division

Mr. Thomas James Clark, engine driver, Crewe, London Midland & Scottish Railway Company.

Mr. William Griffith Lewis, ganger, St. Clears, Great Western Railway Company.

Mr. George William Pearson, Senior Yard Inspector, Southern Railway Company.

Mr. Arthur John Taylor, engine driver, King's Cross, London & North Eastern Railway Company.

Ancillary Businesses of British Railways in 1936

IV.—Road Transport

With one exception, the railway companies' accounts in respect of road transport reflect the increased traffic handled last year in consequence of the revival in trade and industry. The salient figures from the two accounts concerned are shown in the following tables:—

ACCOUNT No. 11 ROAD TRANSPORT

	Gross receipts		Expenditure		Surplus		Per cent. of surplus to gross receipts	
	1936	1935	1936	1935	1936	1935	1936	1935
	£	£	£	£	£	£		
G.W.R. ...	85,080	71,852	69,307	65,489	15,773	6,363	18·5	8·9
L.N.E.R. ...	201,387	182,195	169,709	152,538	31,678	29,657	15·7	16·3
L.M.S.R. ...	396,400	368,536	329,067	309,133	67,333	59,403	17·0	16·1
S.R. ...	24,278	23,263	17,319	16,427	6,959	6,836	28·7	29·4

ACCOUNT No. 16—COLLECTION AND DELIVERY OF PARCELS AND GOODS

G.W.R. ...	982,534	996,725	1,180,186	1,127,277	*Dr.* 197,652	*Dr.* 130,552	—	—
L.N.E.R. ...	1,318,654	1,208,004	1,636,298	1,533,749	*Dr.* 317,644	*Dr.* 325,745	—	—
L.M.S.R. ...	2,275,451	2,133,641	2,682,248	2,528,786	*Dr.* 406,797	*Dr.* 395,145	—	—
S.R. ...	519,195	507,914	499,024	462,990	20,171	44,924	3·9	8·8

In the case of Account No. 11 (Road Transport), it will be seen that every company secured an increase in both gross and net receipts. G.W.R. gross receipts were £13,228 (18·4 per cent.) more than in 1935, and as expenditure increased by only £3,818, the net profit of £15,773 was £9,410 greater than in the previous year. This was the best achievement of the year and was especially creditable in view of the fact that £3,141 was transferred to renewal fund compared with only £1,112 in 1935.

L.N.E.R. receipts advanced by £19,192 (10·5 per cent.), but expenditure rose by £17,171, the net result showing an increase of £2,021 compared with 1935. The L.M.S.R. obtained an increase of £27,864 (7·6 per cent.) in gross receipts; total expenditure rose by £19,934; and the net profit was £7,930 more than in 1935. In the case of this company, it is worth noting that no less than £23,583 was transferred to renewal account in 1936 compared with only £6,682 in the previous year.

The road transport business of the Southern Railway is naturally not so considerable as that of the other companies, but there was an increase of £1,015 in the gross receipts last year. Net profit increased by £123, but £446 was transferred from renewal or suspense account compared with only £6 in 1935.

Account No. 16 relates to the regular collection and delivery services for parcels and goods. All the railways except the G.W.R. showed increased gross receipts last year, but there were substantial increases in expenditure and only the L.N.E.R. was able to secure an improved net result compared with 1935. Even the Southern Railway, the only company which makes a profit on its C. & D. services, suffered a decrease of £24,753 (55 per cent.) in its net revenue, but Mr. Robert Holland-Martin explained at the annual general meeting of the company that this was due to a reallocation of receipts in accordance with a pre-arranged plan.

In considering the collection and delivery services, it has to be borne in mind that they are unique among the ancillary businesses of the British railways inasmuch as they are an essential part of the fundamental business of the railways, and cannot, therefore, be regarded in the same way as the docks or other ancillary undertakings which are self-contained and have a relatively indirect, though nevertheless valuable, connection with the railway. Railway rates must be maintained on a strictly competitive basis, and the addition to the rates in respect of the collection and delivery of goods has, therefore, to be very finely regulated. Without these cartage facilities, however, the railways could not provide the throughout service which traders require, and their value to the companies as "feeders" far outweighs the losses which appear year by year in Account No. 16.

It has been claimed on behalf of the railways that, together with their associated companies, they form the largest road transport undertaking in Great Britain. The following table showing the number of horses and road vehicles owned by the four group companies will afford some indication of the extent of the road transport business undertaken by the companies:—

	G.W.R.	L.N.E.R.	L.M.S.R.	S.R.	Total.
Parcels and goods road vehicles:—					
Motors	2,182	3,249	3,035	609	9,075
Horse wagons and carts	3,022	5,212	15,936	1,047	25,217
Miscellaneous	751	1,169	1,146	198	3,264
Total	5,955	9,630	20,117	1,854	37,556
Passenger road vehicles:—					
Motors	—	45	121	—	166
Horses for road vehicles	1,731	2,372	8,251	771	13,125
Horses for shunting	27	233	138	27	425

It will be seen that the railways own over 37,000 parcels and goods, road vehicles, including 9,075 motors. In addition, they control, through Pickfords, Carter, Paterson & Co., &c., approximately 2,700 motor vehicles and 2,300 horse-drawn vehicles and trailers, thus making a fleet of about 42,000 goods road vehicles under railway control.

The railway companies' fleet of 9,075 parcels and goods motors at the end of last year was 742 (9 per cent.) more than at the close of 1935. The purchase of these additional motors affords some indication of the increase which has occurred in rail traffic requiring cartage. In addition to the ordinary collection and delivery services, an ever-increasing tonnage is being handled by the companies' country lorry and railhead distribution services, while a heavy traffic is continually passing under special contracts arranged in connection with building schemes, road works, and other undertakings.

Included in the 9,075 motors are approximately 2,800 mechanical horses, a type of unit which has become familiar in the streets of cities and large towns in recent years. The great advantage of the mechanical horse lies in the interchangeability of the motive and trailer units, which enables the former to be used to maximum capacity. The companies' stock of containers at the end of 1936 numbered 13,000 compared with 11,240 at the close of 1935.

The capital value of the road vehicles actually owned by the railways is £4,080,377, while garages, stables, &c., represent another £2,670,090. The figures for the individual companies are as follow:—

	Road vehicles		Garages, stables, &c.
	Parcels and goods	Passenger	
	£	£	£
G.W.R. ...	1,149,569	—	253,242
L.N.E.R. ...	1,249,802	66,621	610,641
L.M.S.R. ...	1,258,297	188,479	1,637,733
S.R.	167,609	—	168,474
Total ...	3,825,277	255,100	2,670,090

In addition, the British railways have invested £9,468,367 in passenger road transport undertakings and £2,464,788 in important firms of goods hauliers, making a grand total of £18,683,622 of railway capital in road transport. Detailed particulars of the companies' investments in road transport interests were given in THE RAILWAY GAZETTE of March 12, 1937.

Some Aspects of the Rehabilitation of China's Railways

On Friday last Mr. Kenneth Cantlie, Technical Adviser to the Chinese Ministry of Railways, gave an interesting lecture with the above title before the China Society at 74, Grosvenor Street, W.1, by permission of the Royal Asiatic Society. The introduction to this lecture took the form of a history of the events leading up to the chaotic state of the Chinese railways in 1931, and is published as an editorial on page 929.

From a study of this leader it will be obvious that the task facing the Ministry of Railways in that year was immense. The railways were in ruins, large expenditure was necessary to keep them at work at all, and yet money could be borrowed only on almost prohibitive terms, which still further increased a load of debt so great that the ability of the railways ever to pay it off was already in doubt. The form of capitalisation of the railways was in itself a handicap, as, being a bond, and not a share indebtedness, it was inflexible, and allowed no margin for the bad times then being experienced. Fortunately the bondholders, to their credit, realised the difficulties, and did not adopt an intransigeant attitude which would still further have complicated the position. The foundation of the subsequent improvement in the railways was, therefore, the desire of the Ministry of Railways to honour its indebtedness, coupled with the willingness of the bondholders to take a broad view of the situation.

The volume of freight awaiting the restoration of train services was considerable, and called for the use of every serviceable wagon. Revenues, therefore, soon reached substantial figures, but the railways were in far too serious a condition for these revenues to have any immediate effect on their general position. Their credit was strained to the uttermost to provide the wherewithal to continue operation, while the result of years of neglect was reflected in greatly enhanced operating ratios. Furthermore, unproductive transport and taxation were still at a high level. At the outset, therefore, the Ministry and the railways found that the only possible course was to use available revenues to pay off the most urgent creditors, and thus secure sufficient new credit to continue operation, for which consumable stores and a few vital spares were essential, and equally urgent was the need of 2,000,000 new sleepers. The renewal programmes were all in serious arrears, and on some lines the state of the track was dangerous for speeds of even 20 m.p.h. or sometimes less.

In September, 1931, occurred the Mukden incident which led immediately to the Japanese occupation of Manchuria, and the reduction of the lines under the Ministry by about 3,500 km., but at the same time it rendered permanent the loss of the locomotives and rolling-stock taken away by Chang Tso-Lin. Then four months later occurred the Shanghai affair, which caused an estimated damage of $30,000,000 to the Nanking—Shanghai Railway. These events naturally caused a sharp drop in revenue, and it was not until 1935 that it rose above the figure for 1931. Despite these setbacks, however, the reorganisation of the other lines was proceeding, but interruptions and emergencies continued, and varying subsidies to military expenses and local contributions caused financial uncertainty. Nevertheless, revenues again continued to mount, and payment of wages and salaries, and their arrears, began to be made regularly, thus causing more contentment among the staff. Funds also became available for sleepers, locomotive materials and sufficient spares to permit the shops to cease robbing unserviceable locomotives and rolling stock of parts in order to keep the remainder in repair.

The workshops were choked with unserviceable and wrecked locomotives and rolling stock, and had new capital been cheaper, it would have been uneconomical to repair many of them, but as it was, repairs had to be done as opportunity offered. The general shortage of locomotives and rolling stock was limiting the earnings of the railways considerably, assisted by the facts that (*a*) many wagons were under military control; (*b*) the turn-round was often slow (due to necessarily low speeds); and (*c*) the engines were, on the average, unable to pull more than about 50-60 per cent. of what they should; a vicious circle had been formed. Shortage of rolling stock had first to yield in importance to sleepers and bridges; and also when limited funds became available, repairs to rails and fittings had to be undertaken.

During the wars many bridges had been destroyed, and the damaged spans had been jacked up on to sleeper stacks. Many bent and damaged girders were removed and laboriously straightened and patched; others had to be replaced. Bridges over normally dry water-courses were replaced either by wooden trestle structures or by Irish bridges, and in this way many good or damaged spans were released for use, in whole or in part, for other bridges; here welding was used to some extent and with varying degrees of success.

Due to the many difficulties already mentioned and to practically general single-line working, the traffic departments were hard put to it to keep trains running regularly, and late running sometimes overlapped from one day to the next, necessitating cancellation of trains. It was often impossible to roster engines or crews for return workings, and altogether operation was extremely difficult. By stringent measures, however, the corner was at last turned and improvement became marked.

The general situation, therefore, was that the railways were being gradually rehabilitated from their own revenues despite the many adverse factors already mentioned, but, meanwhile, no money was available for the payment of many of the material debts or bond amortisation, or sometimes even the interest. This depressed China's credit, and unpaid debts were steadily mounting, many of them at heavy compound interest, so that it seemed likely that after all repudiation would be hard to avoid. Fortunately, however, at this time the trustees of the British Boxer Indemnity Fund began to invest on a large scale in Chinese railways. The return of the British share of the Boxer Indemnity took place in 1931, in the form of the creation of a revolving fund in China, the principal of which was to be invested in productive works, and the interest devoted to educational and cultural enterprises; to administer this fund a board of trustees was created. The agreement further provided that the accumulated funds, and half the future instalments, should be expended in buying British goods, while the other half of the instalments should be expended in China or Britain. To conduct the expenditure on goods in Britain, a Purchasing Commission was set up with wide powers. This policy resulted in a considerable number of re-habilitation loans.

At this point Mr. Cantlie diverged from his main theme, to recount the numerous lines now under construction, their scope and the means by which they are being financed. As we have dealt with these already in our Overseas columns from time to time during the past three or four years, we will now pass on to the remainder of the lecture.

Although confidence had been restored by the action of the board of trustees, and the financial position had been eased, revenues were still below the 1931 level, and, despite the establishment of sinking funds, the aggregate debt grew steadily. It was then, however, that the visits of General Hammond and Sir Frederick Leith-Ross revived hopes, and resulted in modifications of the loan agreements and contracts, making it possible for the railways to pay off remaining arrears in time.

From 1931 onwards, the Ministry had realised that there was no hope of obtaining a rehabilitation loan from foreign sources which would be acceptable to the Chinese; also that until the railways could show the world that they were a sound investment, investors, both Chinese and foreign, would be shy of investing money in anything but short-term loans with personal security. Furthermore, it foresaw that the offer of any foreign syndicate to take over and operate one or more of the National lines, paying surplus profits to the Government, would not

be acceptable owing to the difficulty of protecting the railway from interference by the military and also by bandits, who would be certain to gather round a company-owned line in the hope of being bought off. It was the realisation of these facts upon which its policy was consistently based.

Even when the worst was past and the beneficial effects of improvements due to re-sleepering, and the purchase of mechanical spares and stores were felt, shop repairs were still seriously in arrears. These, however, were gradually made up by the backward lines being helped by those in better condition. Later, too, the Ministry decided to control directly the principal workshops, to prevent overlapping of work, and this promising scheme is now materialising.

Meanwhile, standardisation of a general and not too rigid character had been adopted, notably in boilers and 40-ton wagons, and also in tyres, bogies, wheel centres, axles, axleboxes, pistons, piston valves and other essential parts. It was not, however, extended to complete engines as their numbers did not warrant such a policy, but the locomotives designed by the Ministry are essentially up-to-date, as the fine Vulcan-built 4-8-4's prove. The all-steel coach is now standard for main-line use, and the wooden-and-steel car for unimportant traffic.

It will thus be seen that despite seemingly insurmountable difficulties, the Chinese railways are now well on the way to complete recovery, and this fact, together with the really remarkable programme of construction work —aiming at the completion of 1,000 miles of new line a year for five years —is to the lasting credit of the Ministry of Railways and the progressive National Government behind it. Mr. Cantlie modestly refrains from mentioning the important part he, as Technical Adviser to the Ministry, obviously played in all this work. His lecture was concluded with some excellent lantern slides of various Chinese railways.

STAFF AND LABOUR MATTERS

The London Busmen's Strike

On Thursday, May 6, immediately after the completion of a four-day hearing at the Middlesex Guildhall, of the London busmen's claim for a working day of 7½ hours, an Interim Report (Cmd. 5454) was presented by the Court of Inquiry appointed by the Minister of Labour on the previous Friday. The conclusions of the Court were stated as follow:—

(*a*) There is a widespread feeling among the London Central omnibus workers that their work is unduly exacting in its conditions, and injurious to their health in its effect;

(*b*) The conditions chiefly complained of are: speeding up of services, too frequent alteration of schedules, irregularity of meal times, and, in some cases, inadequacy of standing times and of facilities at terminals;

(*c*) Conditions of employment have hitherto been governed by the terms of the agreement of 1932 made before the establishment of the Transport Board, which agreement was in its nature experimental and was brought into existence before the present intensified system of working was in full operation.

We are of opinion that some of the schedules which have originated since the 1932 agreement, while strictly in accord with its terms, operate somewhat onerously upon the men and are not such as could have been accurately foreseen by the parties at the time the agreement was reached.

It is agreed between the parties that in all the matters raised in the discussions that have taken place for the modification of the 1932 agreement, other than the men's demand for a seven and a half hour day, accommodation could have been found between the men's union and the Transport Board.

We consequently feel that negotiations for the settlement of matters in difference, other than that of a reduction of the working day, should proceed at once in accordance with the method ordinarily adopted between the parties.

As regards the claim for a seven and a half hour day, which is based fundamentally on the grounds of injury to health, the evidence placed before us is inconclusive.

Nevertheless, we are of opinion that a prima facie case has been made out for further investigation by a properly qualified body specially constituted to deal forthwith with this important matter.

Should such a body find that the complaints as to injury to health made upon behalf of the men are substantiated, then, in our judgment, immediate and appropriate steps should be taken, either by reduction of hours and/or by such other measures as may be agreed, to meet the position.

We recognise that any recommendation under this head must inevitably place an increased liability upon the Transport Board; but, should satisfactory proof of the need for remedy be forthcoming, we cannot but think that the Transport Board would be assured of the goodwill of the public when budgeting for any extra cost involved.

The report, which was signed by Mr. John Forster (Chairman), Sir Arthur Pugh, and Mr. Basil Sanderson, was at once examined by both sides, and conversations took place at Montagu House between representatives of the Minister of Labour, the London Passenger Transport Board, and the trade union, with the object of bringing about a settlement of the dispute.

On Saturday last, May 8, it was officially stated that the board had made an offer rejecting finally the demand for a 7½-hour working day, but offering many concessions. These included a plan to shorten the working day when an investigation into busmen's health is concluded and a case for shorter hours is established. The board is prepared to discuss with the union:—

Speeding-up of services;
Too frequent alterations of services;
Irregularity of meal times;
Inadequacy of standing times;
Facilities at terminals for washing, eating, &c.; and
Any duty schedules regarded by the men as onerous or unduly exacting.

If agreement cannot be reached on any of these, the Board is willing that they shall be referred for decision either to the court of inquiry which sat last week or to some other body to be set up by agreement between Board and union.

The Board will also join with the union in setting up a properly qualified body to investigate conditions of employment on the men's health.

On Monday, May 10, at the conclusion of a delegate conference of the union, Mr. Bevin, General Secretary, stated that by 47 votes to 3 the busmen had rejected the board's offer and decided to continue the strike.

Yesterday (Thursday) it was reported that the executive council of the union had circulated to the busmen's committee and to the branches concerned an analysis of the interim report of the court, and of the board's last offer. Further meetings of the branches, and possibly of the delegate conference, are now expected to follow.

G.W.R. Robins Bolitho Ambulance Competition.—The annual competition for the Robins Bolitho ambulance challenge shield took place at the St. John Ambulance Brigade Headquarters, Penzance, on April 28. The contest is open to Great Western Railway teams in West Cornwall, and there were four entries. Each team had to deal with two patients, in a test demanding both discrimination and promptitude. Dr. J. P. S. Ward, of Tavistock, adjudicated. The result was as follows: first, Truro Loco., 72 marks; second, Truro Traffic, 70 marks; third, St. Ives, 68½ marks; fourth, Penzance, 52 marks. Mr. E. Lake, Divisional Engineer, Plymouth, presided over the presentation, held at the Western Hotel, and at which Mrs. E. H. W. Bolitho had provided tea for the assembled company. Dr. Ward complimented the competitors on their treatment in a test by no means easy. Mrs. Bolitho handed the trophy to the Truro Loco. team, and congratulated them on their success. A vote of thanks to Mrs. Bolitho for her attendance and kind interest was passed, and Mr. Lake also expressed thanks to Mr. P. Thomas, in whose capable hands the arrangements had been carried out, and to Mrs. G. B. Morris, who had arranged the repast.

L.N.E.R. Poster Art

As we recorded last week, the twelfth annual exhibition of L.N.E.R. poster art was opened at the New Burlington Galleries, London, W.1, on May 4, and closes at 5 p.m. today. A selection of the posters is reviewed herewith.

Variety of appeal is again the keynote of the company's poster advertising, and in this direction the L.N.E.R. is well served not only by the talents of its artists, but by the wide range of subjects within its area which it offers for their inspiration. The gaiety of seaside resorts; the dignity of fine buildings; colourful historical associations; and the exhilaration of open country—all these are represented among this year's posters.

One artist, Mr. Fred Mason, specialises in an individual treatment of architectural interiors—so many celebrated examples of which are to be found in the cities served by the L.N.E.R. To heighten the effect and relieve the sombre tones of ancient masonry, he contrasts with it a splash of colour in the shape of some ecclesiastical procession or civic pageantry. The atmosphere of spaciousness is enhanced by its relation to human figures, who, in return, provide a touch of ceremonial brilliance to attract the eye. Examples of such treatment are Mr. Taylor's posters of Liverpool Cathedral and York Minster.

For those with leanings to open spaces and distant prospects, there will be a particular appeal in the "Yorkshire Dales" posters of Alison McKenzie—who combines pleasing colour with modernity of line—and Gabain, whose quieter composition leads up to an ancient castle ruin in the background. There is a similarly spacious air about Guy Malet's "Knaresborough," with the effect of distance even reinforced by a tree-bordered river, leading the eye to remote ranges of hills. But scenery may be enjoyed from the railway as well as on arrival, and Mr. Frank Mason reminds travellers of this in a fine poster of a train passing along the Yorkshire coast, near Whitby. The same artist contributes industrial studies, including an animated scene at St. Andrew's Fish Dock, Hull.

The "straight" scenic poster, in which the artist draws his effect from the form and colour of his subject rather than from an adroit selection and presentation of its dominant features, has always been an appreciated item in the L.N.E.R. poster range. A fine example this year is Mr. E. W. Hazlehurst's "Teesdale." Doris Zinkeisen boldly and successfully adapts the artistic styles of past centuries to modern railway advertising in her posters "Queen Elizabeth at Cambridge," and "Dick Turpin's Ride to York."

An addition is made this year to posters for individual or combined display, as exemplified by the series we reproduced in our issue of April 17 last year. This year, travellers seen through the windows of an L.N.E.R. green and cream tourist train give pictorial interest to announcements of various facilities, and when several of these posters are placed together, the effect is as of a series of windows in a single train.

A most interesting feature of the exhibition this year is a display of old railway bills, contrasted with present-day announcements in the com-

Railway and scenic interest combined in an attractively coloured poster by Mr. Frank Mason

IT'S QUICKER BY RAIL
SIXTEEN L·N·E·R RAMBLING GUIDES
FROM BOOKSELLERS AND L·N·E·R OFFICES 6D EACH
ASK FOR THE ONE COVERING THE DISTRICT YOU REQUIRE
IT'S QUICKER BY RAIL
EAST COAST BY L·N·E·R
PENNY A MILE MONTHLY RETURN TICKETS
IT'S QUICKER BY RAIL
TWO NEW PUBLICATIONS
"A ROUND OF GOLF" BY BERNARD DARWIN
"SALMON & TROUT RIVERS" BY JOCK SCOTT
FROM BOOKSELLERS AND L·N·E·R OFFICES 1- EACH

The above posters, by Mr. Tom Purvis, may be displayed separately or posted together as shown to give the effect of a section of one of the L.N.E.R. green and cream tourist trains

pany's standard type and colouring. Beginning with an old G.N.R. advertisement for a Peterborough—London excursion to see the Great Exhibition of 1851, there is seen to have been very leisurely progress typographically right up to the nineteen-twenties. Alongside, are shown present-day announcements in Gill sans., as standardised for the company's advertising in 1932, and by this means, combined with colour, even lists of train departures are made attractive compositions.

Fast Running on the L.M.S.R.

The inaugural run of the accelerated 4.10 p.m. L.M.S.R. express from Liverpool to London, now due at 7.40 p.m. or 30 min. earlier than previously, was very successful, the 97·1 miles from Nuneaton to Euston being run in 89 min. 15 sec., or 2¾ min. less than schedule, despite permanent way slowings through Kilsby tunnel and near Hemel Hempstead. No. 6112, *Sherwood Forester*, of the 4-6-0 "Royal Scot" class, was the engine, and the load a light seven-coach formation weighing 233 tons tare and 245 tons gross. From Nuneaton the acceleration was so rapid that, despite gradually rising grades for some miles from the start, 81 m.p.h. was attained shortly after Brinklow, and Rugby, 14·5 miles, was passed in 15 min. 12 sec., at the usual reduced speed. Owing to the Kilsby slack, the next 7·3 miles to Welton took 9 min. 23 sec., but from Welton to Cheddington 39·2 miles were covered at a continuous average of 79·4 m.p.h., and an average of 84·4 m.p.h. was maintained over the 19·7 miles from Roade to Leighton. The maxima were 80 m.p.h. at Weedon and 90 m.p.h. at Castlethorpe, with a minimum of 73 at Roade, and good work was involved in the continuance of 80 m.p.h. as far as Leighton, with no lower minimum than 76 up the ensuing rise to Cheddington. Tring summit was cleared at 64 m.p.h., the engine having been slightly eased as the train was before time, and speed had reached 78 m.p.h. when the Hemel Hempstead slowing was made. After that speed rose to 75 m.p.h. at Watford and 84 at Wembley; the conclusion of the run was a very cautious entry from Watford to the terminus. The 15·4 miles from Welton to Roade occupied 12 min. 25 sec., the 13·2 miles on to Bletchley 9 min. 18 sec., the 15·0 miles from Bletchley up to Tring 11 min. 40 sec., the 14·3 miles from Tring to Watford (including the p.w. slack) 13 min. 29 sec., the 12·0 miles from Watford to Willesden 9 min. 13 sec., and the final 5·4 miles into Euston 8 min. 35 sec. For the 97·1 miles from Nuneaton to Euston the net time was about 85½ min., and for the 82·6 miles from passing Rugby about 70¼ min. Another of the accelerated trains—the 10.10 a.m. from Northampton to Euston—on the same day covered the 46·7 miles from Bletchley to Euston in 45 min. 55 sec., including the Hemel Hempstead slack, or about 44 min. net from start-to-stop, climbing the 15·0 miles to Tring in 15 min. 15 sec. from the start, with a minimum speed of 63 m.p.h., and touching 80½ m.p.h. at Wembley. The engine was compound 4-4-0 No. 1107 and the load 185 tons.

Great Western Royal Hotel, Paddington

The Great Western Royal Hotel, Paddington, was opened on June 9, 1854, and apart from a few minor alterations the structure remained unaltered until a few years ago when the directors decided that it should be enlarged and modernised throughout. In order to minimise as far as possible the inconvenience to visitors it was decided to carry out the work in three stages. The first of these was the construction of a new wing, comprising a lounge, smoke-room, cocktail bar, and 52 bedrooms, each having its own separate bathroom. This portion of the work was completed and brought into use last year.

The second stage, which has now been practically completed, included the construction of a carriage way to the entrance hall, the refacing and repainting of the hotel exterior, the modernisation of the dining room and the renovation of all the bedrooms on the west side, including the provision of bathrooms to practically all the rooms. Particular attention has also been given to the modernisation of the kitchens which are now exceptionally spacious, well-lit, and well-equipped with all the latest appliances. This accommodation includes a well-equipped office for the chef and dressing and mess rooms for the kitchen and waiting staff. Included in this stage of the work is the provision of a new grill room with direct access from the dining room and a separate entrance from the Down approach road, but although this work is well in hand, it will not be completed for some weeks yet.

To mark the completion of the dining room, Sir Robert Horne and a number of the company's directors and officers held a small luncheon party on Wednesday, May 5, following which representatives of the Press made a tour of the building. The final stage of the work, which is expected be put in hand shortly provides for the enlargement and modernisation of the main entrance hall and the renovation of the whole of the remaining bedrooms on lines similar to those already completed. When the whole of this work is finished in about twelve months' time, the hotel will accommodate 250 visitors and, with the exception of a few single rooms, every bedroom will be provided with its own bathroom and embody all the latest improvements in furnishings, lighting, and so forth. The new facilities have already evoked many appreciative comments from visitors.

Questions in Parliament

Railway Air Services

Mr. W. R. D. Perkins (Stroud—C.) on May 5 asked the Under Secretary of State for Air, whether he could give an assurance that railway air services would not be allocated any portion of the internal air services, as suggested by the Maybury Report, in view of their present attitude encouraging British passengers to fly by German or Belgian air lines in preference to British air lines.

Sir Philip Sassoon (Under Secretary of State for Air): The intention of the Government, as provided for in Section 5 of the Air Navigation Act, 1936, is to set up a licensing authority for the regulation of internal air lines. For this purpose an Order in Council will be laid before the House in due course and will require the approval of the House. The question of the conditions to be specified in the Order still remains for settlement, but it had not been contemplated that a discrimination should be exercised against air services in which railway companies were interested so long as the licensing authority was satisfied that the most effective service to the public would be provided.

Railway-Air Passengers

Mr. W. R. D. Perkins on May 5 asked the Under Secretary of State for Air what progress, if any, had been made in the negotiations with the railway companies with regard to their booking agents encouraging British passengers to fly on German and Belgian air lines in preference to British air lines.

Sir Philip Sassoon: I am informed that favourable progress has been made in the negotiations which have been taking place in regard to the use by British Airways Limited of the booking facilities of travel agencies, and I understand that agreement has been reached with the railway companies by which British Airways will be given the use of the booking agencies for its *Continental services*.

Parliamentary Notes

Progress of Railway Bills.—A Select Committee of the House of Lords, with Lord Carnock as Chairman, has been appointed to consider a group of five Bills which includes those of the L.M.S.R. and L.N.E.R., and will hold its first meeting on Tuesday, June 8. The House of Commons will on Monday, May 24, consider the Lords' Amendments to the Great Western and the Southern Railway Bills. The London Passenger Transport Board Bill will come on Tuesday, June 8, before a Select Committee of the House of Lords, presided over by Lord Cozens-Hardy. Eight petitions have been deposited against the Bill including those of the Corporation of London, the City of Westminster, the Hertfordshire County Council, the Borough Councils of Kensington and Southwark.

THE MONTH'S RAILWAY LAW

The Interests of Coastal Shipping

The Railway Rates Tribunal has to bear in mind two considerations when fixing a standard charge under the Railways Act, 1921, and they are (1) to secure to the railway company its "standard revenue," and (2) to ensure that persons using the railway shall not be prejudiced. By Section 37 (1) of the Act, a railway company can grant an exceptional rate up to 40 per cent. below standard without the consent of the Rates Tribunal, but beyond that the consent of the tribunal is necessary. In both these cases however if "any class of users of the railway" is prejudiced or the standard revenue is jeopardised, the Minister of Transport may refer the matter to the Rates Tribunal. The interests of coastal carriers are protected by Section 39 which provides that anybody considered by the Board of Trade to represent the interests of shipowners or canal proprietors may complain that exceptional rates are being charged which compete with coastal and canal shipping in a manner detrimental to the public and which are inadequate, having regard to the cost of the service, whereupon the Minister may refer the matter to the Rates Tribunal for review. For the purpose of this hearing a member is added to the tribunal from "the shipping panel" which consists of six persons appointed by the Board of Trade to represent the interests of coastal carriers.

Shippers and the Rates Tribunal

Great Western Railway Co. v. *U.K. Chamber of Shipping.* (1937) 2 *A.E.R.* 138.

A consideration of the preceding paragraph will show that it is only at an inquiry under the Railways Act, 1921, s. 39, (now under the Road and Rail Traffic Act, 1933, s. 39), that shippers and coastal carriers can allege that an exceptional rate is unfair. In *Great Western Railway Co.* v. *U.K. Chamber of Shipping* the chamber opposed an application by the company under Section 37 for leave to grant an exceptional rate over 40 per cent. below standard on the ground that it might compete unfairly with coastal shipping Counsel for the railway company took the preliminary point that on an application under s. 37 the tribunal had only to consider the effect of the proposed rate upon users of the railway and that upon this question the Chamber of Shipping had no right to be heard. As counsel for the company said, it would be intolerable if whenever they desired to reduce their charge, they could be met with opposition from any competitor. It is Section 39 and not Section 37 which enables the coastal carriers to object if the exceptional rate proves prejudicial. "It is only after the shoe pinches" said Lord Justice Scott "that those other parties who are feeling the pinch have a right to complain to the tribunal that the public interest is prejudiced by the new rate." The objection of the railway company was therefore upheld. It is a matter of interest, too, that the Court of Appeal in coming to this conclusion approved *Great Western Railway Co.* v. *Bristol Corporation* which decided in 1928 that the only relevant question was the effect of the new rate on the revenue of the railway, and that the prejudicial effect on the carrier was—under Section 37—irrelevant.

Two Railway Employees' Cases in the "Lords"

Knowles v. *Southern Railway Co.*
Alderman v. *Great Western Railway Company. The Times,* April 18.

These two cases were discussed in these columns when they were decided in the Court of Appeal. They were workmen's compensation cases and in one case the workman, and in the other his dependants, appealed to the House of Lords. In both these cases the appeals were dismissed.

In the first case Mr. Knowles pulled up his van at Southwark and went for a glass of beer, leaving the van-guard in charge. He returned and was mounting to his seat when he slipped and the van passed over his body causing his death. It was against the company's express rule to go for a drink while on duty. Consequently when he left the van Mr. Knowles took himself out of the scope of his employment and he had not returned to duty when the accident happened. For he was only doing acts which had to be performed owing to his breach of duty, in order to regain control of his horses. The result was that the workman was not acting in the course of his employment and the accident did not arise out of it.

In the second case Mr. Alderman, a travelling ticket inspector, had travelled as was his wont, from Paddington to Swansea, where he went off duty in the evenings, finding his own lodgings. Next morning he went on foot to Swansea station to sign on for duty again and take the train to Oxford via Paddington. He slipped in the street when nearing Swansea station and broke his ankle, which incapacitated him for six months. He applied for compensation, but this was refused by the Court of Appeal and now by the House of Lords. The judges held that at the time of the accident Alderman was for all purposes in the position of an ordinary member of the public, using the streets on his way to work. "The course of employment only continues while the workman is lawfully upon the employer's premises." Nothing which happened between the man's signing off and signing on again could be said to have happened in the course of the employment, and so Mr. Alderman's claim failed.

Procedure at Company Meetings

Carruth v. *Imperial Chemical Industries Limited,* 53, *The Times,* L. R. 524.

The comments of Lord Blanesburgh in his judgment in the House of Lords in the Imperial Chemical Company's case are of interest to all companies, including railway companies.

In that case a scheme of arrangement was under consideration and meetings of separate classes of shareholders were held in succession one after another—preference, ordinary, and deferred. But no attempt was made to separate the shareholders of each class from the whole body summoned for the general meeting. The chairman made one speech and the vote was then taken of the ordinary and deferred shareholders without further speeches. There were thus "two general meetings and three separate polls." Lord Blanesburgh considered that the meeting of the deferred shareholders, owing to the presence of shareholders of other classes, was not a separate meeting within the company's memorandum of association at all, and that it could not be so regarded. The resolutions were held to have been duly passed, because there were no proceedings to set them aside. But this expression of opinion is interesting, because Mr. Justice Clauson, and indeed the Court of Appeal, were of opinion that the meetings as held were in order and constituted "separate" meetings within the definition.

COLVILLES LIMITED.—At the sixth annual general meeting of Colvilles Limited on April 22, Mr. John Craig, the Chairman, said that the trading results for 1936 showed an improvement over 1935 more by reduced costs and increased output than by an increase in selling prices. The new plant at Motherwell and Glengarnock did not come into effective operation until this year. The company had a scheme for erecting on the company's existing properties at Clyde Iron works coke ovens to produce about 7,000 tons of coke a week, also two additional blast furnaces each capable of producing about 3,500 tons of pig-iron a week. Along with the blast furnaces there would be installed plant for the handling of ore and also for sintering. At Clydebridge it was proposed to construct additional melting furnaces, and another plate mill on somewhat similar lines to the existing one, but adapted for lighter plates. The company had purchased recently from the liquidators of David Colville & Sons Ltd. the business of Archibald Russell Limited, coal masters, a company with collieries in Lanarkshire and Stirlingshire. The works of the subsidiaries which had been acquired had been, and were steadily being, improved. The company had a full contract book and there was every sign of the present demand being continued for some time. The output for the first quarter of this year showed substantial improvement.

NOTES AND NEWS

New Thames Valley Halt, Furze Platt.—The new halt between Maidenhead and Cookham which is being provided by the Great Western Railway is to be called Furze Platt.

The Andaluces Railway Headquarters.—The Andaluces Railway Company has announced its intention to transfer its administrative headquarters from Malaga to Seville.

Mersey Air Ferry Service.—An aerial ferry service across the Mersey between Speke Airport and Hooton Park has been inaugurated by Utility Airways, a new company.

Railway Students' Association Presentation.—During the course of the annual convention of the Railway Students' Association of London University held in Edinburgh last week, Mr. L. W. Orchard, Chairman of the committee, presented a cheque on behalf of the association to Mr. R. C. Smith, who was recently appointed District Electrical Engineer, Birkenhead, L.M.S.R.

Explosion on Bordeaux - Marseilles Train, P.L.M.—On May 5 as a Bordeaux to Marseilles local train was running at speed between Raphele and St. Martin-de-Crau stations, an explosion occurred and subsequently a fire broke out involving two carriages. One person was killed and three slightly injured. It has been established that the explosion was due to the bursting of a bomb.

L.N.E.R. to Work Wembley Park Goods Yard.—In connection with the realignment of lines at Wembley Park, the London Passenger Transport Board has made arrangements whereby the working of goods and coal traffic to and from Wembley Park goods yard, and the working of the yard itself, shall be taken over by the L.N.E.R. The transfer will take place at an early date, and similar facilities will be available for traders as those at present in operation at this point.

Railways and Coronation Traffic.—Precise information is not yet available regarding the special passenger traffic for the Coronation carried by the railways. Although the number of persons using the Underground must have been near a record, the system worked admirably and no serious delays occurred. An item of interest was the special train between High Street Kensington and Westminster stations, reserved for the use of peers, peeresses and members of Parliament. The train left Kensington at 9 a.m. and was scheduled to run non-stop to Westminster; it was the only train to use this station, which was closed to the public all day. The passengers reached the Houses of Parliament from the station by means of the private subway. Eight hundred tickets at threepence each were available and were distributed by the Speaker. On the main-line railways traffic which had been growing steadily throughout the week reached a peak on the night of May 11, when scores of excursion trains carrying tens of thousands of passengers ran into the great termini of London. Besides the excursionists, enormous crowds were brought in by ordinary long-distance expresses and suburban and local trains. Some expresses ran in no fewer than five portions.

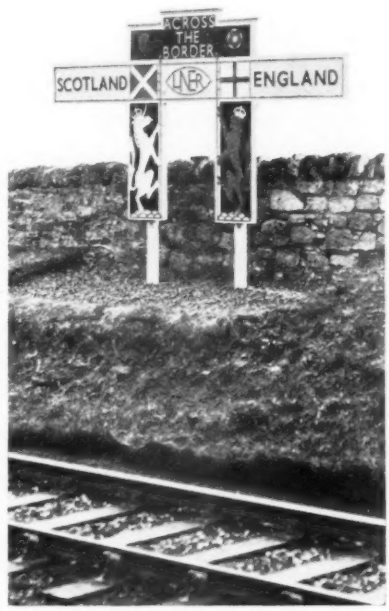
New Decorations, L.M.S.R. Midland Hotel, Morecambe.—Mural decorations of an unusual description representing the four seasons of the year have been carried out by Mrs. Beatrice MacDermott for the Empire Café, L.M.S.R. Midland Hotel, Morecambe. Mrs. MacDermott is the wife of Norman MacDermott, the founder of the Everyman Theatre and a well-known theatrical producer.

Institution of Locomotive Engineers, Summer Meeting.—The summer meeting this year, from May 26 to May 30, will be held in Ireland. Members will cross to Belfast on the evening of May 26, and, after visiting the works of Harland & Wolff Limited, proceed to Dublin the following day. While in Dublin visits will be made to the Inchicore works of the Great Southern Railways, and there will be motorcoach tours to Glendalough, and the Vale of Avoca. The institution dinner will be held on May 28, and the party returns on May 30. The Locomotive Engineers' Golfing Society will hold its spring meeting in conjunction with the visit on May 28 and 29.

Naming of Locomotives for L.N.E.R. "Coronation" Express.—The five new streamlined Pacific locomotives which are being built specially for working the London-Edinburgh "Coronation" trains (to be inaugurated on July 5), are to be given the names of various countries of the Empire, as follow: *Dominion of Canada*; *Commonwealth of Australia*; *Dominion of New Zealand*; *Union of South Africa*; *Empire of India*. Special permission has been accorded for the use of these names, and it is proposed to arrange for naming ceremonies to take place within the next few weeks, which it is hoped will be honoured by the presence of the High Commissioner of the country concerned in each case. It is understood that these locomotives, to be streamlined similarly to the Pacifics of the "Silver Link" class, will incorporate certain novel features in their general design and appearance intended to harmonise with the "Coronation" trains.

Northern Ireland Transport Board.—The Governor of Northern Ireland has, in pursuance of Section 40 of the Road and Railway Transport Act (Northern Ireland), 1935, appointed Mr. John Clarke MacDermott, K.C., Mr. Wilfred Hugh Fitzsimons, F.C.A., and Mr. John Pike, O.B.E., to be the Transport Appeal Tribunal for Northern Ireland for the purposes of the Act, for a term of five years. Mr. MacDermott has been appointed Chairman of the Tribunal. The most important of its functions will be the consideration of applications for the revision of any fares or rates chargeable by the Transport Board or any railway company, or for the modification of any conditions applicable to such fares or rates, or for the revision of any charges made for the provision of services or facilities in connection with the carriage of merchandise.

"Across the Border."—Passengers travelling by the L.N.E.R. East Coast route between England and Scotland will be in no doubt in future as to when they cross the Border. The L.N.E.R. is endeavouring to add interest to railway journeys by erecting on the lineside signs marking places or objects of note, and such a sign with national characteristics has just been placed on each side of the main line about one mile north of Berwick-on-Tweed, denoting



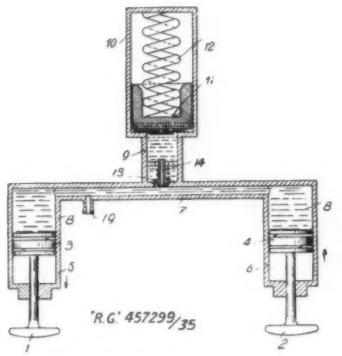
the actual border line between Scotland and England. The sign, bearing the wording "Across the Border" at the top in yellow lettering on a black background, is 14 ft. in width and some 9 ft. high. On one side appears the Thistle (green and purple), St. Andrew's Cross (blue and white), and the Scottish Unicorn (white and gold on black), with an arm pointing towards Scotland lettered "Scotland" in black letters on a yellow background. On the other side is the Rose (red and green), St. George's Cross (red and white), and the Lion Rampant (red and gold on black), with a similar arm lettered "England" (black on yellow).

ABSTRACTS OF RECENT PATENTS*

No. 457,299. Buffers for Railway Vehicles

Jean Mercier, of 118, Avenue des Champs Elysées, Paris VIII, France. (*Convention date: France, March 12, 1935.*)

In a balanced buffer wherein the forces of the two buffers under the effect of shocks and recoil are equalised between the two buffers by a damping device, the buffers 1 and 2 are rigid

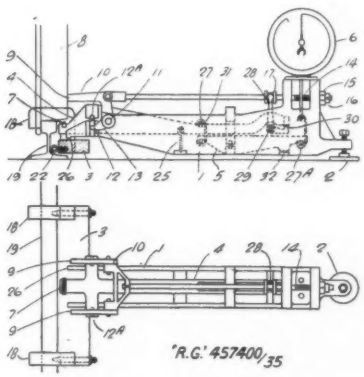


with two pistons 3 and 4 movable in two cylinders 5 and 6 secured to the car on either side of its median longitudinal axis. These two cylinders 5 and 6 communicate with each other by a conduit 7 and contain fluid. The chamber 8 located on the sides of the pistons opposed to the buffers 1 and 2 contain an incompressible liquid. These two cylinders 5 and 6 also communicate through a conduit 9 with a third cylinder 10 which is fixed on the car, and in which a piston 11 is movable. This piston is subjected on the one hand to the pressure transmitted by the liquid and on the other hand to the pressure of a spring 12 in the cylinder 10. A valve 13 provided with a small passage 14 is arranged in the conduit 9 in order to permit liquid to flow freely from the conduit 7 into the conduit 9 towards the cylinder 10, by lifting the valve 13, and to restrict the flow of liquid from the cylinder 10 towards the conduit 7 by compelling it to pass through the small orifice 14. The spring 12 which acts on the piston 13 pushes the incompressible liquid and both pistons 3 and 4 in such a manner that in the position of rest these pistons 3 and 4 are in the middle part of the cylinders 5 and 6. When a train runs on to a curved part of the track the buffers of adjacent cars located on the inner side of the curve, push each other inwards and the pistons 4 expel some of the liquid into the cylinders located on the outer side of the curve so that the corresponding buffers are pushed outwardly and remain in contact. The spring 12 is powerful enough to resist the slight stresses developed during these displacements. When the buffers 1 and 2 undergo a violent shock simultaneously, the liquid is discharged from the cylinders 5 and 6 by both pistons 3 and 4, lifts the valve 13, and pushes back the piston 11 against the action of the spring 12 which thus absorbs the shock. The spring 12 slowly discharges the liquid through the passage 14 and brings back the pistons 3 and 4 into their normal positions.—(*Accepted November 25, 1936.*)

No. 457,400. Portable Weighing Machines for Locomotives and Other Rail Vehicles

Albert Leuton, and Saml. Denison & Son Ltd., both of Hunslet Foundry, Leeds 10 (*July 17, 1935*).

A portable weighing machine comprises a base 1, resting on the ground at the outer end on a shoe 2, and on

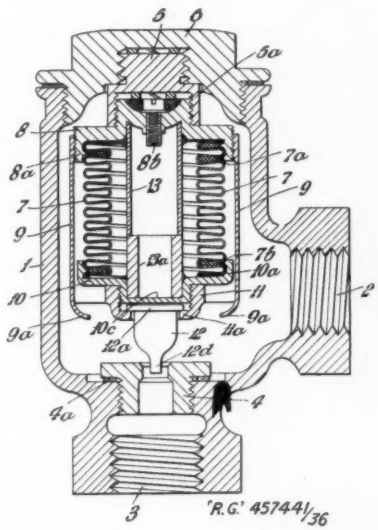


the rail-borne carrying member 3 at the inner end. The weighing lever 4 and subsidiary lever 5 communicate the load to an indicator 6. The main load knife-edge 7 is clear of the tyre 8 in the non-weighing position, and stops 9, on lever 10, fulcrumed on pins 11 rest against the tyre. The fulcrum knife-edge bushes 12, carried in guides in the frame, are raised by arms 13, on lever 10, and screw 14 is operated by nut 15. A collar 16, when up against nut 15, denotes the home position of the rod. In using the machine, turning the nut 15 draws the rod forward, and by operating lever 10 raises bush bearing members 12, and with them the weighing lever 4 and knife-edge 7, into contact with the tyre. At the same time the stops 9 retire and leave the wheel clear for weighing. The nut is operated until collar 17 is arrested by the frame casting, and in this position the wheel tyre is lifted clear of the rail, and the weight wholly borne by the weighing levers. The machine is supported at the correct height in relation to the running surface of the rail by resting on toes 26, on the main bar 3, of a carrying member or horns portion resting on the rail 19. To prevent derangement of the weighing parts during transportation the lever 4, has a definite force exerted upon it from a bell crank lever 28, pivoted at 29, on the main frame, and exerting an upward force on the lever at 30, about knife-edge 31, when the screw 14 is operated. This causes the fulcrum knife-edge 12*a* to press hard into contact with bush members 12, and by increasing the tension in links 27 and 27*a*, cause lever 5 to press upwards against its seating. The bell crank lever 28 retires clear of the lever 4, in the weighing position. Stops 32 prevent derangement of lever 5. A spring 25 presses the weighing lever 4 upwards, and this maintains tension in links 27 and 27*a* to keep the levers pressing into their seatings; it further enables the indicator to start at zero.—(*Accepted November 27, 1936.*)

No. 457,441. Steam Traps

Sarco Company Inc., and Herbert James Clement Wells, both of 183, Madison Avenue, New York, U.S.A. (*June 10, 1936.*)

A steam trap comprises a main body portion 1 having a side inlet opening 2 for connection with a source of steam, and a downwardly extending outlet 3 connected to a return pipe. Above the outlet is a seat 4 which is provided



with an outlet for the condensate, and which forms a seating for the body portion of the valve, an intermediate gasket 4*a* ensuring a tight joint. The top of the body portion is closed by a cap 6 in the form of a nut screw-threaded to engage the interior wall of the body 1, the opening being large enough to permit the removal of the valve. The valve structure is securely connected to the cap 6 by means of an intermediate screw connection and a part 5*a* which receives an externally

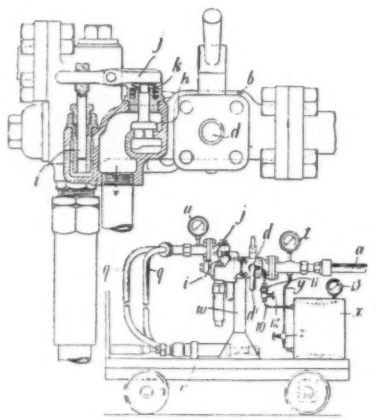
* These abridgments of recently published specifications are specially compiled for THE RAILWAY GAZETTE by permission of the Controller of His Majesty's Stationery Office. Group abridgments can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2. either sheet by sheet as issued, on payment of a subscription of 5s. a group volume, or in bound volumes, price 2s. each, and the full specifications can be obtained from the same address price 1s. each.

screw-threaded projection on the upper end plate 8 which closes the bellows. The valve structure comprises a bellows element 7 of corrugated metal forming screw-threaded convolutions. The upper end of the bellows 7 is closed by a plate 8 which envelopes these convolutions. This screw joint is soldered at 7*a* to ensure hermetical sealing. The plate 8 also screws into a metal tubular shield 9 which surrounds the bellows. A small opening closed by the screw-threaded portion 8*b* is provided for the insertion of the volatile liquid within the bellows. The lower end of the bellows is closed by a plate 10 having a rim 10*a* which envelopes the convolutions, the joint being afterwards soldered as at 7*b*. A threaded nut 11 has a downwardly and inwardly extending rim 11*a* which supports the head of the valve 12, provided with a flanged portion 12*a*. The body portion of the valve passes through the opening 11*a* and is provided with a stem 12*d* which projects into the seating 4. Inside the bellows 7 are two concentric tubes 13 and 13*a* placed end to end; the upper end of the tube 13 projects into a recess in the plate 8 while the lower end of the tube 13*a* projects in the plate 10. These tubes serve to limit the contraction of bellows 7 by abutting, and they also serve as a guide for the bellows. The incoming steam striking against the bellows causes the volatile liquid to expand and close the valve. When the condensate has collected sufficiently to cool the controlling parts, the bellows will contract until the tubes 13 and 13*a* abut, when the valve 12 will be lifted off its seat 4 and the condensate passes out through the opening 3. The steam then causes the valve to close again as described above.—(*Accepted November* 27, 1936.)

No. 457,457. Washing Apparatus for Locomotives

Richard David Metcalfe and James Croxon Metcalfe, both of Injector Works, Romiley, Chester (*May* 27, 1935).

A washing apparatus is supplied from a boiler with steam which passes by way of a flexible pipe *a* to the injector *b*. Water is supplied by a flexible pipe d^1 controlled by the cock d^2. Overflow takes place by means of the valve *h* which is loaded by the pressure in the injector delivery chamber through a plunger *i* and lever *j*. A spring *k* frees the stem of the valve *h* of any loading pressure when the injector is starting up. The delivery from the injector is taken by flexible connections *q* to spray nozzles *r*, each having a control valve *s*, to regulate the delivery from the nozzle. The apparatus has a steam inlet pressure gauge *t* and a delivery pressure gauge *u*, and is mounted on a pedestal *w* on a truck *v*. As the water and steam supplies are obtained by way of flexible connections d^1 and *a*, the truck can be wheeled alongside a locomotive and the spray nozzles directed where required. The steam issuing under a high pressure and temperature penetrates and clears away oily dirt, and the cleaned surface, being heated by the water, quickly dries. A tank *x* containing oil is also provided and steam pressure is admitted to the bottom of the tank by the pipe *y* having a control valve *z*. The upper end of the oil tank is connected by means of the pipe 10 and a sight feed glass 11 having a regulating valve 12, with the water inlet branch *d* of the injector. Water condenses in the pipe *y* and enters the tank *x* under pressure so that the oil floats and is expelled through the pipe 10. It may be desired, after washing, to give the locomotive an oily finish. The steam valve *z* and the oil valve 12 are opened with the result that oil is forced from the upper part of the tank *x* to the water supply pipe *d*, the quantity of oil admitted being regulated by the valve 12. The sight glass 11 shows the quantity of oil passing. The oil becomes mixed with the water supply

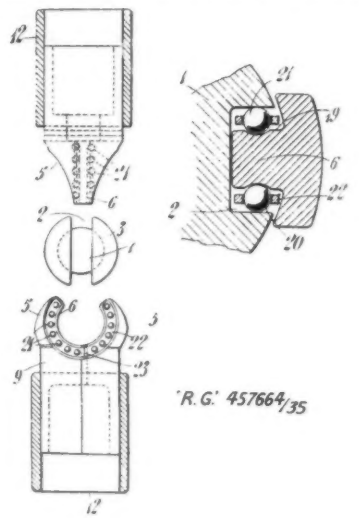


to the injector producing an emulsion which is sprayed on to the locomotive giving it a finishing coat.—(*Accepted November* 27, 1936.)

No. 457,664. Universal Joint

Arthur John Mollart and John Charles Hendra, both of the Mollart Engineering Company, Thames Ditton, Surrey (*June* 5, 1935).

A universal joint has a ball 1 which unites the two forked ends and is provided with two peripheral grooves 2 and 3 at planes at right angles. Each fork end comprises two semi-cylindrical parts 9 which are united together by a tightly fitting external sleeve 12, and each part 9 has integral with it a fork end 5 with an internally projecting spline 6. When each fork is assembled, the splines 6 form one continuous spline which encircles the ball 1 by more than 180 deg. The splines 6 are of considerably less breadth than the grooves 2, 3; on each side of the splines and within the groove, can therefore be accommodated a series of balls 21 and cage elements 22. The balls 21 and cage elements 22 in each fork comprise a ball bearing between the spline and the walls of the groove 1 or 2. The sides of the splines 6 are slightly channelled to form ball races. The adjacent ends of complementary cages 22 may be interattached. Each series of balls 21 subtends the same total angle at its fork, but may be somewhat longer linearly if desired. When a fork deflects by internal rotation around the ball 1, the balls and



their races will "creep" through an angle equal to about half the deflection, and clearance must be allowed for such movement. The walls of the grooves 2 and 3 may, instead of being parallel splines, be slightly conical, being struck from the ball 1; in which case the walls of the splines 6 are likewise conically disposed.—(*Accepted December* 3, 1936.)

COMPLETE SPECIFICATIONS ACCEPTED

456,909. Roberts, W. S., Burton, J. H., and Railway Signal Co. Ltd. Block signalling systems for railways and the like.

457,010. Erith's Engineering Co. Ltd., and Ferguson, A. W. B. Underfeed stokers for Lancashire and other boilers with cylindrical flues.

457,059. Budd Manufacturing Company, E.G. Vehicle bodies.

457,500. White, G. Doors or tailboards for lorries, vans, wagons, railroad, and other vehicles.

457,558. Devlin, S. R. Connections for articulated railway and like carriages.

457,582. Krupp A.G., F. Sole plates for rails, and tools for their manufacture.

457,586. Steyr - Daimler - Puch A.G. Combined rail and road wheels for vehicles.

457,597. Vereinigte Eisenbahn-Signal-Werke Ges. Speed-supervising devices for railway vehicles, operated from the track.

457,720. Main, D. W. Combined road and rail vehicle.

457,883. Armstrong, Whitworth & Co. (Engineers) Ltd., Sir W. G., Watkins, D. J., Spaink, J. H. Abbink, and White, J. Means for ventilation of engine electric locomotives or motor coaches.

OFFICIAL NOTICES

South Indian Railway Co. Ltd.

THE Directors are prepared to receive Tenders for the supply of :—

1. TWO LOCOMOTIVE TANK ENGINES (M.G.).
2. LAMINATED SPRINGS.

Specifications and Forms of Tender will be available at the Company's Offices, 91, Petty France, Westminster, S.W.1.

Tenders addressed to the Chairman and Directors of the South Indian Railway Company Limited, marked "Tender for Locomotives," or as the case may be, with the name of the firm tendering, must be left with the undersigned not later than 12 Noon, Friday, the 11th June, 1937, in respect of Specification No. 1, and not later than 12 Noon on Friday, the 28th May, 1937, in respect of Specification No. 2.

The Directors do not bind themselves to accept the lowest or any Tender.

A charge, which will not be returned, will be made of £2 for each copy of Specification No. 1 and of 2s. 6d. for each copy of Specification No. 2.

Copies of the drawings may be obtained at the Offices of the Company's Consulting Engineers, Messrs. Robert White & Partners, 3, Victoria Street, London, S.W.1.

E. A. S. BELL,
Managing Director.

91, Petty France,
Westminster, S.W.1.
11th May, 1937.

Bengal-Nagpur Railway Co. Ltd.

THE Directors are prepared to receive Tenders for :—

500 STEEL TYRES.

Specification and Form of Tender can be obtained at the Company's Offices, 132, Gresham House, Old Broad Street, London, E.C.2, on or after Monday, 10th May, 1937.

A fee of 10s. will be charged for each copy of the Specification, which is *NOT* returnable.

Tenders must be submitted not later than Noon on Friday, 21st May, 1937.

The Directors do not bind themselves to accept the lowest or any Tender and reserve to themselves the right of reducing or dividing the order.

By Order of the Board,
T. R. WYNNE,
Managing Director.

DRAUGHTSMEN, Senior and Detail Men required for Aircraft constructional work. Apply stating full particulars to : EXPERIMENTAL AIRCRAFT DRAWING OFFICE, THE BRISTOL AEROPLANE CO. LTD., Filton House, Bristol.

OFFICIAL ADVERTISEMENTS.

OFFICIAL ADVERTISEMENTS intended for insertion on this page should be sent in as early in the week as possible. The latest time for receiving official advertisements for this page for the current week's issue is noon on Thursday. All advertisements should be addressed to :—*The Railway Gazette*, 33, Tothill Street, Westminster, London, S.W.1.

RAILWAY AND OTHER REPORTS

German State Railway.—The German State Railway announces the distribution of a dividend of seven per cent. on the preference shares for the business year 1936.

Midland Railway Company of Western Australia.—The directors have authorised an interim payment of interest on the second mortgage cumulative income debenture stock on account of the year ending June 30, 1937, of 2 per cent. (the same), payable on July 1.

Atchison, Topeka and Santa Fé Railway.—Total net corporate income for 1936 amounted to $9,998,125, compared with $9,554,315 for 1935. Preferred dividends absorb $6,208,640, and the 2 per cent. distributed on the common stock last September took $4,854,120. The surplus carried forward is reduced from $298,291,160 to $296,584,685.

Emu Bay Railway.—Gross and net revenue for the year 1936 showed a considerable increase over the 1935 figures, and the traffic increased very materially with the starting-up of the Rosebery mine. After setting aside £7,114 as provision for depreciation and upkeep of rolling stock, &c., and extinguishing the debit balance of £7,074 brought forward from 1935, there was a credit balance of £2,646 available, out of which the sum of £2,618 has been appropriated for payment on April 1 to the credit of holders of the £130,900 of 4½ per cent. debenture stock, on account, leaving £28 to be carried forward.

Bársi Light Railway.—Approximate results for the year to March 31, 1937, as shown in the interim report, are : Gross earnings, Rs.15,25,400, working expenses, Rs.10,90,500, compared with Rs.19,26,216 and Rs.11,34,729 (actual figures) respectively in the previous year. A serious outbreak of cholera interfered with the attendance of pilgrims at the big Ashadi Fair in July, and the failure of the monsoon produced practically famine conditions in the area served by the railway. To the resulting failure of the local crops and the consequent poverty of the people must be ascribed the heavy fall in earnings. Warrants for the preference dividend were paid on April 1, 1937, but the directors regret that, in view of the above, and the fact that there are few signs yet of improved conditions, they are unable to recommend an interim dividend on the ordinary stock.

City of Oxford Motor Services Limited.—The accounts of this company, which is controlled jointly by the Great Western Railway Company and the British Electric Traction Co. Ltd., show that the profit for the year 1936 amounted to £26,581, in comparison with £29,054 for 1935. Adding £5,669 brought forward makes a total of £32,250, of which £7,500 is transferred to reserve, £4,810 is applied to preference dividend, and £14,175 to a dividend of 10 per cent., free of tax (the same) on the ordinary shares, leaving £5,765 to be carried forward.

Yorkshire (Woollen District) Transport Co. Ltd.—Profits rose from £91,315 in 1935 to £94,602 in 1936. Adding the balance of £10,553 brought in makes a total available of £105,155. The dividend is unchanged at 10 per cent. for the year, requiring £44,000, £40,000 is again placed to reserve, and £7,500 (the same) is added to employees' assistance fund, leaving £13,655 to be carried forward. This company, which is controlled jointly by the L.M.S.R. (with 133,333 shares), the L.N.E.R. (with 66,667 shares), and the British Electric Traction Co. Ltd., was formerly the Yorkshire (Woollen District) Electric Tramways Limited. The present title was adopted on May 9, 1935 ; tramways were finally abandoned on October 31, 1934, and the company now works over 200 buses in the Dewsbury neighbourhood.

A. Reyrolle & Co. Ltd.—Net profit for 1936 is £130,743, against £114,336 for 1935. A sum of £40,000 (comparing with £30,000) is set aside for development expenditure, and the dividend for the year is maintained at 12½ per cent., leaving £128,336 to be carried forward, as against £118,893 brought in. The value of orders received and the sales of the company's productions were greater than in the previous year, and there was a large increase in the amount of uncompleted work in hand. The increasing volume of work has made it necessary to put in hand extensions to the company's factories and equipment, some of which are now in progress.

W. T. Henley's Telegraph Works Co. Ltd.—The directors recommend a final dividend on the £1,300,000 of ordinary stock of 6¼ per cent., making, with the interim dividend of 1s. 6d., a share paid on £650,000 of capital on October 1 (which interim dividend is equal to 3¾ per cent. on the present capital), 10 per cent. for the year 1936. They also recommend a cash bonus of 5 per cent. and a centenary cash bonus of 3¾ per cent. for the year, all payable together. These payments will make a total of 18¾ per cent. on the present capital for the year 1936, which is equivalent to 37½ per cent. on the capital before the bonus issue of 100 per cent. was made in December last, compared with 22½ per cent. for the preceding accounting period of nine months.

Scammell Lorries Limited.—Gross profits for the year 1936 amounted to £84,303, a slight reduction on the figure for the previous year, but owing to savings effected in general expenses, depreciation allowance, &c., the net outcome of the year's operations was a profit of £10,323, in comparison with a loss of £5,589 for 1935. After eliminating the debit of £4,338 brought forward and writing off the note issue expenses, amounting to £2,568, a credit balance of £3,417 remains to be carried forward. Sales of all classes of the company's products were well maintained, and at the end of the year orders on hand were at a higher figure than at any previous period. Orders on hand for the new Scammell rigid eight-wheeler commercial vehicle, which was introduced during the year, are very satisfactory. The railway companies have extended their fleets of mechanical horses, and the company is about to introduce a smaller model, which is now undergoing its final trials.

CONTRACTS AND TENDERS

The Metropolitan-Cammell Carriage & Wagon Co. Ltd. has received an order from the Bengal North Western Railway to the inspection of Messrs. Rendel, Palmer & Tritton for nine metre-gauge third-class bogie coaches, 5 ft. 6 in. over headstocks, to be fitted with Sheffield-Twinberrow bogies.

Banting & Tresillian Limited has received an order from the Bombay, Baroda & Central India Railway, to the inspection of Messrs. Rendel, Palmer & Tritton, for the supply of 31 copper firebox plates.

Stothert & Pitt Limited has received an order, to the inspection of Messrs. Rendel, Palmer & Tritton for the supply of six two-ton electric portal cranes for the Karachi Port Trust.

Brown Bayley's Steel Works Limited has received an order from the South Indian Railway, to the inspection of Messrs. Robert White & Partners for 164 laminated springs for carriages and wagons.

D. Wickham & Co. Ltd. has received orders for two Ford-engined saloon inspection railcars for the Entre Rios Railways and one similar railcar for the Argentine North Eastern Railway.

The Bengal-Nagpur Railway Administration has placed orders with Beche & Grohs for a machine for rolling in tyre retaining rings and with the Cambridge Instrument Co. Ltd. for five recording pyrometers.

The Chinese Ministry of Railways has decided to purchase twelve passenger locomotives and ten freight locomotives for the Nanking-Shanghai and Shanghai-Hangchow-Ningpo Railways.

The Hunslet Engine Co. Ltd. has received an order for three size 20 traction couplings to transmit 78 h.p. at 1,050 r.p.m. for the Admiralty.

The Tata Iron & Steel Co. Ltd. has received orders from the Indian Stores Department for quantities of mild steel round and sheet.

Greaves, Cotton & Co. Ltd. has received an order from the Indian Stores Department for one 110 kW. oil-engine-driven generating set, at a total price of Rs. 35,070.

A.C.E.C. (India) Limited has received orders from the Indian Stores Department for a quantity of paper insulated 660-volt cable.

Shaw, Wallace & Co. Ltd. has received orders from the Indian Stores Department for 1,800 broad-gauge 3-ft. 7-in. dia. steel tyres, at a total price of Rs. 150,300.

The Indian Rubber Manufacturers Limited has received orders from the Indian Stores Department for the supply of 3,200 sets of india-rubber buffer springs, 4,400 sets of india-rubber side buffer recoil springs, and 160 sets of india-rubber auxiliary bearing springs, at a total price of Rs. 66,649.

George Spencer Moulton & Co. Ltd. has received an order for 28,680 india-rubber springs for carriages and wagons from the Buenos Ayres Great Southern Railway.

The directors of the Great Western Railway Company have authorised the placing of the following contracts :—

Supply of Road Vehicles

Express Motor & Body Works Limited : 30 Morris tractor chassis.

Taskers of Andover (1932) Limited : 40 articulated trailer chassis ; 16 articulated low-loading trailer chassis ; two 6-ton articulated pole trailers ; 30 sets of articulated coupling gear for tractors.

Scammell Lorries Limited : 10 special 3-ton Scammell A.L. trailer chassis.

Latil Industrial Vehicles Limited : 6 Latil tractors.

Tersons Limited : Extension of the goods shed at Brentford Town goods depot.

John Morgan Limited : Reconstruction of Gadlys bridge, near Aberdare.

A. E. Farr Limited : Reconstruction and lengthening of Criccieth Road bridge, Portmadoc.

T. Oakley Limited : Demolition and removal of Pwll-y-pant Viaduct, and a bridge near Llanbradach.

Horseley Bridge and Thomas Piggott Limited : Supply and erection of water softening plant at Severn Tunnel Junction.

For Swindon Works

The Projectile & Engineering Co. Ltd.: Supply of a triple drum sand-papering machine.

Wilkins & Mitchell : Supply of a double-acting stripping press.

For the Overhaul of the following Vessels

Penarth Pontoon Slipway & Ship Repairing Co. Ltd. : Ss. *Roebuck*, the tug *Swansea*, the dredger *Mudeford*, the steam hopper barge *G.W.R. No.* 2.

Harland & Wolff Limited : Ss. *Sambur*.

Port Talbot Graving Dock & Shipbuilding Co. Ltd. : The tug *Trusty*.

Balmer, Lawrie & Co. Ltd. has received orders from the Indian Stores Department for 1,140 cwt. of m.s. angles and sheet.

Guest, Keen, Williams Limited has received an order from the Indian Stores Department for 852 3-ft. 7-in. dia. broad-gauge carriage and wagon tyres, 850,000 m.s. keys and 725,000 m.s. split cotters.

Samuel Osborn (India) Limited has received orders from the Indian Stores Department for 800 3-ft. 7-in. dia. broad-gauge carriage and wagon tyres.

The Indian Iron & Steel Co. Ltd. has received orders from the Indian Stores Department for a total of 650 tons of pig iron.

J. O'Hara Murray & Co. (India) Ltd. has received orders from the Indian Stores Department for 3,788 steel superheater flues and 40 steel pipes.

R. Wright & Partners has received an order from the Indian Stores Department for 1,504 broad-gauge 16-ton steel axles.

The Great Southern Railways, Ireland is reported to have purchased Drumm batteries to the value of £45,000 from Drumm Battery Sales.

The Swiss Locomotive & Machine Works has received an order from the Acieries du Nord, Paris, for 45 further complete sets of oil speed gears of which this firm has already supplied 78 sets to the same company. These gear boxes are designed for direct power transmission on standard diesel railcars of the French Nord, Est, and P.O.-Midi Railways.

The Chief Controller of Stores, Indian Stores Department (Electrical Section), invites tenders, receivable by June 1, for the supply of 48,000 rubber cell separators for the Eastern Bengal Railway and 5,000 wooden or perforated ebonite cell separators for the G.I.P. Railway.

The Chief Controller of Stores, Indian Stores Department (Engineering Section), invites tenders, receivable by June 3, for the supply of axles, tyres, and wheels required for the G.I.P. and E.I. Railways.

U.S.S.R. Orders Placed in the United Kingdom

The total value of U.S.S.R. orders placed in Great Britain in March of this year, amounted to £2,607,742 as compared with £1,088,283 in March of last year. The figures for the first quarter of this year were £7,368,130 as compared with £2,188,576 in the first quarter of 1936, a more than threefold increase.

The following table shows orders placed and purchases made of engineering and allied materials and equipment in Great Britain in March and in the first quarter of this year as compared with 1936.

As can be seen from the above figures, there has been a large increase in orders for machinery and equipment, which were this year nearly 45 times as large as in 1936.

—	March		January to March	
	1936	1937	1936	1937
Machinery and equipment	£22,751	£263,081	64,402	£2,863,709
Ferrous alloys and steel	14,279	100,305	13,135	180,157
Non-ferrous metals	455,952	1,378,752	780,969	1,862,768
Rubber	144,538	405,212	393,552	1,107,842

Diesel Railway Traction

The New Sulzer Engine

ENGINES of the conventional vertical or vee types developing 2,000 b.h.p. or more are limited at the moment to one make, the Busch-Sulzer, in the U.S.A. Rightly or wrongly, makers have felt that the time has not yet come when a practicable engine could be built to such a design, but the growing call for high-power engines for locomotive work has resulted in work proceeding on double crankshaft designs, the first two of which, built by the French Sulzer Company, have been finished and are being installed in one of the two 4,000 b.h.p. locomotives of the P.L.M. Railway. It may be thought by those with a bent in the direction of simplicity that anything with two crankshafts is bound to be complicated, but actually there is little to cavil at in this direction so far as the Sulzer engines are concerned, and they are more simple and straightforward than many a vertical engine with one bank of cylinders. Moreover, they are a splendid engineering job, not only in the methods and details of their construction, but also in the principles adopted for the drive of the generator and the support of the three constituents (engine, step-up gears, and generator) which form the power plant. As may be seen from the curves presented elsewhere in this issue, the fuel consumption is low—and consistently low over the whole working range. In engines of 2,200 b.h.p. installed in locomotives making big mileages, this is of importance on cost alone, but in addition it indicates that the interior of the engine is cleanly in its habits. By the incorporation of a supercharger the high output of the engine has been obtained within a most reasonable bulk and weight, and the high brake m.e.p. of 115 lb. per sq. in. on the one-hour rating of 2,200 b.h.p. is a pointer to what can be achieved quite safely with modern engines, and with an improvement in the specific fuel consumption. As a result of careful investigation into the advantages and disadvantages of pressure-charging the Sulzer firm has adopted it, if not as a standard, at least very largely for new construction, and, including the two P.L.M. engines, pressure-charged Sulzer railway engines aggregating over 13,000 b.h.p. are completed or in course of construction.

Harold Sinclair

ONE of the best and most dependable interpositions between a railway oil engine and its mechanical transmission (where such is used) is a fluid coupling, for not only does it assist in the easier manipulation of the vehicle, and protect the components of the gearbox from undue shocks from the driving end, but it acts also in the opposite direction and prevents shocks and extra loads from the track and transmission reaching the engine. Apart from certain railcars in this country and France, the almost universal fluid coupling is the Vulcan-Sinclair brand, in its traction or ring-valve forms. Its successful development and application in rail traction is due mainly to Mr. Harold Sinclair, who, as a recognition of the outstanding contributions he has made to the evolution of fluid transmission in many branches of engineering, has just been awarded the Edward Longstreth medal of the celebrated Franklin Institute, in the U.S.A. Although this medal is generally considered as the highest international award for fluid transmission work, Mr. Sinclair already is in the happy position of a prophet not entirely without honour in his own country, for he received a Thomas Lowe Gray prize from the Institution of Mechanical Engineers for his paper "Recent Developments in Hydraulic Couplings," read in 1935. Although the application of Vulcan-Sinclair fluid couplings to stationary and marine installations far outweighs in quantity the present use in railcars and locomotives, we believe that the rail traction side is one which appeals particularly to Mr. Sinclair because of the opportunities it gives him to exercise his knowledge and ingenuity, and included in the development work he has done recently are the adaptation of the fluid coupling to very high engine speeds and the perfecting of the Voith-Sinclair turbo transmission.

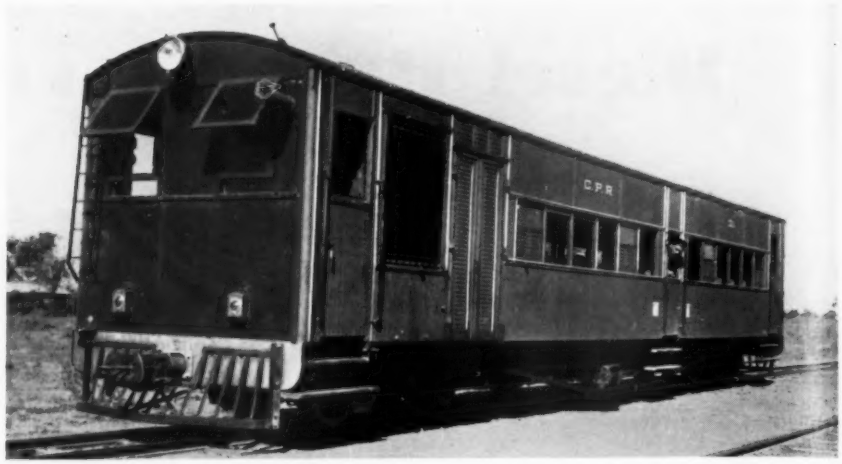
Horizontal Oil Engines

ENGINES arranged entirely below the floor have been a feature of railcar practice for about three years, and as the desideratum of maximum revenue-earning floor space, without any projections, appears to increase in importance, there is every likelihood that further developments of the horizontal engine will take place in the near future. Several designs are actually at work, mostly of Continental origin, and they range from 120 to 275 b.h.p. on the continuous rating. There is a further engine, the Henschel, which has an output of 300 b.h.p., although it is unusual in that all its applications have been to road transport, including a number of high-speed passenger buses running over the Reichs-Autobahnen. As indicated in our issue of January 22, the Reichsbahn has collaborated with a number of German engine builders in the production of a range of horizontal engines, which embody the particular maker's special designs, but incorporate standard mounting arrangements, fuel pumps and auxiliaries, and have virtually the same overall dimensions. These engines are being made by Deutsche Werke Kiel, M.A.N., Deutz, and Daimler-Benz, and all run at 1,500 r.p.m. The same rotational speed is used in other German horizontal engines such as the Henschel (300 b.h.p.) and the Magirus (150 b.h.p.). All these types have the *vis-a-vis* layout or "boxer-motor" as the ensemble is styled in Germany, but Vomag has a 185 b.h.p. engine with only one cylinder bank (see issue of this Supplement for February 21, 1936), which has been developed recently into a two-bank horizontally-opposed design of 360 b.h.p. In the U.S.A., the Hall-Scott company has an eight-cylinder single-bank design of 200 b.h.p. which has been proposed for use in some railcars for South America. Other designs are the 120 b.h.p. eight-cylinder Skoda engine in Czechoslovakia and the small Krupp air-cooled engine, one example of which was running in Spain.

XUM

SUCCESSFUL RAILCAR OPERATION ON THE G.I.P.R.

Bus competition eliminated in up-country area by intensive diesel railcar service



140 b.h.p. diesel-electric railcar for 2 ft. 6 in. gauge lines

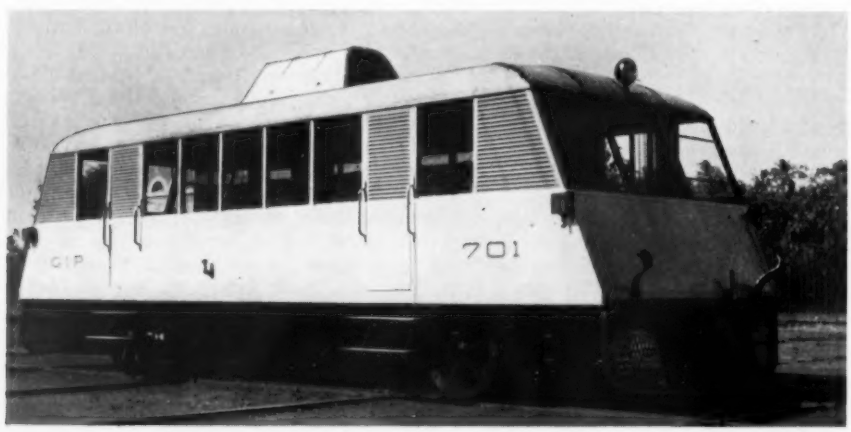
AMONG the railcars at work on the Great Indian Peninsula Railway are both petrol and diesel types, the latter being limited to a single car on the 2 ft. 6 in.-gauge Central Provinces section. The petrol cars, as illustrated at the bottom of this page, operate on broad gauge lines.

The diesel car is of the Armstrong-Whitworth type with an Armstrong-Saurer engine and electrical transmission. A light-weight body was built at the Matunga carriage shops of the G.I.P.R., and seats 58 third class passengers and has a driving compartment at each end. The chassis and bogies were built in England. The tare weight of the car is 16·2 tons and normally it hauls an 11-ton bogie trailer at speeds up to 40 m.p.h. The passenger compartment is carefully insulated from the engine room by a double partition which is packed with asbestos so that very little engine-room noise is heard in the passenger compartment.

The controls in the forward driving compartment consist of a small drum type controller fitted with a deadman handle, a Westinghouse driver's brake valve, a hand brake, and an instrument panel which is fitted with a Westinghouse brake gauge, a lubricating oil pressure gauge, a dial thermometer, a speedometer, and a dash-board light. In the centre of the rear wall of the driver's cab is the door into the engine room. On the left is a panel containing the electrical gear, such as fuses, starting contactor, battery-charging relay, &c. On the right is a radiator cooled by a belt-driven fan, and on the floor below the radiator is situated a small motor-driven compressor for supplying air to the Westinghouse brakes. Up above are mounted the fuel oil tank, cooling water tank, and the silencer.

The engine-generator set follows normal Armstrong-Whitworth practice in that it has a three-point suspension on a subframe. The points of suspension are fitted with Silentbloc rubber bushes, and the frame carrying the set is mounted on rollers, so that after disconnecting the fuel oil pipes, cooling water pipes, and generator cables, the whole unit may be run out on to a platform, and the spare unit run in.

This railcar was introduced on the Pulgaon-Arvi branch line in 1934 and has proved a great success. Actually, the car works daily without relief, and at a distance of over a hundred miles from the nearest depot. Any maintenance work required must be done at night without much assistance from skilled workers or proper appliances. At Pulgaon two platforms are provided, each built of scrap metal and rails. One platform holds the spare engine-generator set, and when the engine is due for overhaul



Petrol-engined railcar powered by Ford V8 engine built by the G.I.P.R. and operating between Burhampur and Jalgaon in the Bhusaval district. It carries 55 passengers and has a top speed of nearly 60 m.p.h. The wheels are of welded steel construction and have 60 rubber blocks fitted between tyre and wheel centre to act as shock absorbers. The wheel diameter is 2 ft. 8 in.

the railcar is run into the shed and the engine-generator set run out on to the empty platform; then by moving the car about 8 ft. the engine-room door is opposite the platform containing the spare set, which is run in and coupled up. The whole operation usually takes from 3 to 4 hr.

At present the car is scheduled to work 176 miles a day and has an aggregate mileage of over 120,000 miles, a most satisfactory figure considering the narrow gauge, low maximum speed, and rather unfavourable conditions. Both the fuel and lubricating oil consumptions are reasonable, and it is only occasionally that the cooling water supply needs replenishment, and runs exceeding 2,000 miles have been made without adding fresh water. One very noticeable point is the low temperature in the engine room even when the car has just returned from a trip. The reason for this is that the air is drawn in through louvres and exhausted through the radiator, and thus all the heat picked up by the cooling air is thrown out from the car instead of being drawn into the engine room and then expelled.

By means of the intensified and accelerated service worked by this diesel-electric car, and a reduction in the basis of charge for the lower class passengers from 4 to 3 pies per mile, bus competition within the area has been virtually eliminated.

MODERN RAILCAR DEVELOPMENT IN NEW ZEALAND

Six-wheeled 130 *b.h.p. petrol-engined railcar, "Maahunui"*

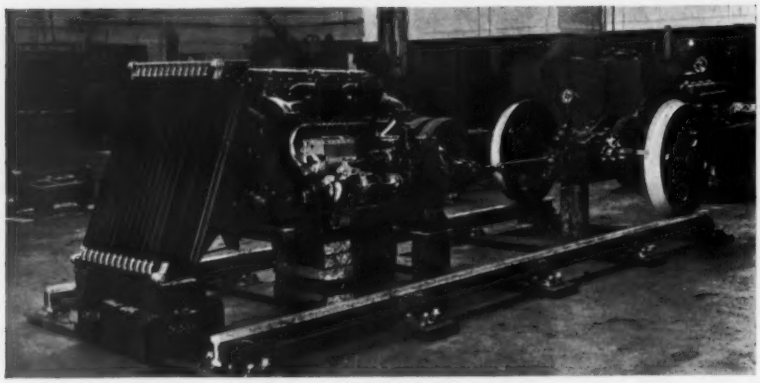
A MUCH greater use of railcars is projected by the New Zealand Government Railways, and the budget for the year beginning April 1, 1937, contains an allowance of £150,000 for railcars, some of which, of course, will be devoted to the purchase of the six double-bogie double-engined cars with Leyland oil engines and hydraulic transmission ordered at the end of 1936. Apparently, petrol-engine propulsion which was utilised in six of the seven cars set to work last year, has been given up in favour of oil-engine power for new construction.

The first diesel service was that introduced in 1935 between Christchurch and Greymouth, via Otira tunnel, with a light six-wheeled vehicle powered by a 95 b.h.p. Leyland oil engine and driving through Leyland hydraulic transmission. It is used for night journeys, and has comfortable seats for 20 passengers and special facilities for mail and newspaper traffic. It was under contract to deliver newspapers at Greymouth by 7.0 a.m. on the morning of printing. The car tares only 7½ tons and has a length of 25 ft. and a wheelbase of 14 ft. 6 in.

Another series of railcar services is in operation in North Island between Wellington and Palmerston North, and is worked by the six-wheeled Leyland 130 b.h.p. petrol-engined cars, which also have hydraulic transmission. These cars have a lavatory and accommodation for 49 passengers. The maximum speed is just over 60 m.p.h., that is, about 10 m.p.h. faster than the 95 b.h.p. diesel car. All of these petrol cars bear names originating from Maori history and mythology. The route from Wellington to Palmerston North includes the celebrated Rimutaka incline which includes three miles up at 1 in 14 —worked by Fell rack engines and brake vans with centre rail grip brakes, but of course the railcars have no rack apparatus and with a b.h.p. of over 10 per ton of fully laden weight they find no difficulty in ascending the grade by adhesion alone.

The last of the order for petrol railcars actually has been modified, and has a 130 b.h.p. six-cylinder Leyland oil engine of that company's standard type. As usual, Leyland hydraulic transmission is incorporated and drives the rigid axle at the rear of the car. The body of this car also is different from those of its petrol predecessors, for it is intended for light goods and perishable traffic, including cream and milk, between Wellington and Woodville, and will also carry schoolchildren along the line between their local stations and the most convenient schooling centre.

The car, named *Arawa*, after one of the famous canoes of early Maori voyages, has four compartments including the driver's section and an office for the guard. Immediately behind the driver is a compartment for 25 schoolchildren; it is fitted with seats of a type similar to that



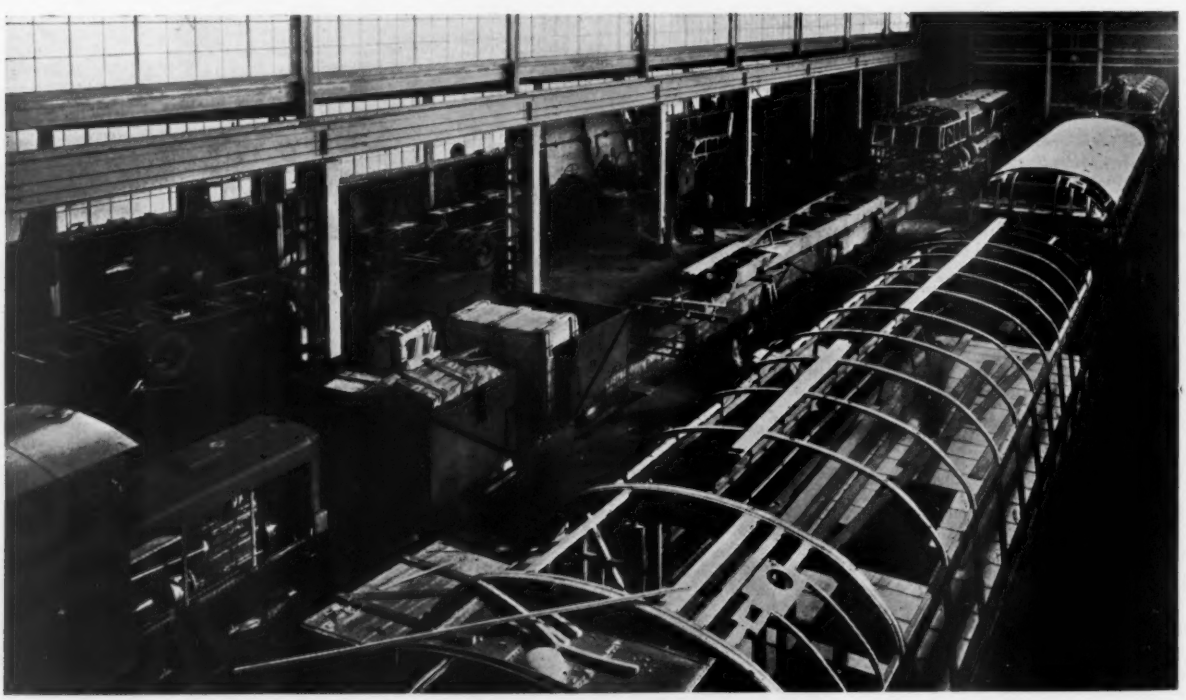
Leyland 95 b.h.p. oil-engined power-transmission set for the New Zealand Government Railways. The hydraulic torque converter immediately behind the engine is of the Leyland (Lysholm-Smith) type. The reversing gears are incorporated in the axle drive

which has been made standard for New Zealand railcars, but somewhat smaller in size and arranged differently. Thermostatically-controlled heating is installed. The goods compartment, situated between the passenger section and the guard's compartment, is equipped similarly to the usual railway goods van. It is metal-lined and has cross battens of wood, to protect the walls and luggage, and has sliding doors on each side for quick access between station platforms and the van for the goods carried. The guard's compartment is somewhat more roomy than that provided on train vans, and has large windows to give a clear outlook in each direction. It is comfortably fitted with desks, cupboards, letter-racks, ambulance equipment, an air-cushioned seat, and an electric heater. Chromium silver fittings are used throughout the car. The windows are of the latest ratchet-grip type, and the interiors, apart from the goods compartment, are mahogany finished.

On a trial run the *Arawa* carried a test load of 2½ tons in the goods compartment, which brought the total weight up to 17 tons. The three miles of 1 in 14 grade from Cross Creek to the summit of Rimutaka was covered in 18 min., and the whole run in each direction between Wellington and Masterton (66 miles) was covered in less than three hours on each occasion, despite stops for crossings with other railcars *en route*.

The six big double-bogie cars now being built are to be used at speeds up to 70 m.p.h. between Wellington and New Plymouth, a distance of 250 miles. They will be used at first on the night journeys. A total of 64 seats will be provided in two compartments. Each of these cars will be powered by two Leyland 130 b.h.p. oil engines driving Leyland hydraulic torque converters (Lysholm-Smith type), and Mr. G. H. Mackley, general manager of the New Zealand Government Railways, has stated that should they prove as popular as anticipated, a very extensive use will be made of such vehicles in various localities, a statement which is amply supported by the figure of £150,000 in this year's budget.

As with all the modern railcars of the New Zealand Government Railways, the bodies and mechanical portions generally have been built at the railway workshops at Hutt Valley. All the bodies are of steel and incorporate welded construction, and all the six-wheeled cars have single-end drive and only one door per side.



Interior of the Hutt Valley workshops of the New Zealand Railways with several railcars under construction

A REBUILT RAILCAR, KOWLOON-CANTON RAILWAY

Used either as an observation car in rear of an express train or as an independent petrol-driven unit, this car is luxuriously equipped, and is capable of 60 m.p.h. on the level

The parlour-observation railcar, "Taipo Belle"

IN 1923 the administration of the British section of the Kowloon-Canton Railway purchased from San Francisco a Hall Scott railcar having a 150-h.p. petrol engine giving just over 60 m.p.h. at 700 r.p.m. Under the direction of Mr. R. D. Walker, the Manager and Engineer, this car has now been converted in the railway workshops into a streamlined luxury car which can be attached in rear of an express train either as an ordinary observation car or as a slip coach, or can be run independently as an express railcar.

The car is divided into three compartments, one housing the engine, the second is a bar-lounge and the third an observation parlour compartment. The engine compartment is separated from the bar lounge by a double bulkhead to insure the shutting out of all engine noise from the rest of the car. The engine and driving bogie are insulated from the main underframe by hardened rubber blocks, and the streamlined steel sheeting is carried down to within 12 in. of the track. The trucks are of the equaliser bar type.

An inaugural non-stop run from Kowloon to Canton was made on October 14 with a full complement of passengers, the 111 miles being covered in 2¼ hr., despite 20 tokens picked up *en route*, single line working and non-interlocked stations, necessitating severe speed restrictions. The 22-mile British section, of which 8 per cent. is on 5-deg. and sharper curves, and 20 per cent. is on 1 in 100 gradients, was covered in 30 min., and the time for the 89-mile Chinese section was 105 min. (= 51 m.p.h.). Over 60 m.p.h. was maintained on favourable stretches of line.

The interior decoration and furnishing, which are most attractive, were designed by Mrs. Walker, wife of the Manager. Artistic curtains and carpets to match, lights, a book-case and vase-lamp, table and reading lamp and deep lounge chairs are provided, also spacious windows giving excellent uninterrupted views. A cocktail bar with swivel chairs and two settees has a refrigerator and ample cupboards and washing-up equipment. The general fittings and decoration can be seen from the illustrations; the metal fittings are chromium plated. Asbestos millboard and a 6-in. air space are used to insulate the hardened compressed wood ceiling from the roof. Silent fans are fitted to ensure adequate air circulation.

For private parties the car may be reserved on payment of 24 fares. The return fare to Shum Chun (22 miles) is $3 and to Canton $12, or about 1d. a head a mile. So popular is this car, which is named the *Taipo Belle*, that the administration is now building a second similar one to be known as the *Canton Belle*.

Interior of main lounge, looking into the bar lounge

4,000-B.H.P. LOCOMOTIVES FOR THE P.L.M. RAILWAY

Unit with Sulzer engines of new design is now completed

THE first of the two super-power diesel-electric locomotives ordered over two years ago by the P.L.M. Railway has now been finished and is to be shown to the delegates to the International Railway Congress at Paris in the beginning of June. The locomotive completed is that powered by the Sulzer engines, and built by the Cie des Forges et Acieries de la Marine et d'Homecourt. It will be remembered that the two locomotives were designed to haul fast trains up to 450 tons in weight between the French capital and the Riviera. A diagram and the main dimensions of each of the two types were given in our issue of March 22, 1935, and the diagram of the Sulzer-Homecourt locomotive is again reproduced herewith.

The Sulzer engine has two banks of six vertical cylinders each with its own crankshaft and driving one main generator through spur gears with a step-up ratio. The twelve cylinders are 310 mm. by 390 mm. (12·2 in. by 15·4 in.) and with the supercharger in operation they give a 1-hr. output of 2,200 b.h.p. at 700 r.p.m. (at the output side of the gears). Actually this rating has been maintained for two hours. The compression pressure is about 48 kg. per sq. cm. (670 lb. per sq. in.) and the maximum cylinder pressure about 58 kg. per sq. cm. (820 lb. per sq. in.). Indicator cards taken at and near full load show a most decided constant pressure combustion shape.

The engine is governed to run at 400, 500, 600 and 700 r.p.m. and has the Sulzer form of electro-pneumatic governor with the solenoids mounted on the step-up gear casing, and the governor and servo motor to one side of the engine at the gear end. The normal speeds and ratings are:—

400 r.p.m.— 750 b.h.p. 500 r.p.m.—1,200 b.h.p. 600 r.p.m.—1,900 b.h.p. 700 r.p.m.—2,200 b.h.p.	All at output side of step-up gears and all with supercharger in operation.

The fuel consumption curves show a very flat line from about 1,400 to 2,200 b.h.p. (with supercharger in operation), the consumption being 175 gr./b.h.p. hr. at 2,200 b.h.p. (700 r.p.m.), and 167·7 gr./b.h.p. hr. (min.) at 1,900 b.h.p. (600 r.p.m.). The average fuel consumptions from the tests on the bench were as given below:—

All with "domestic" fuel oil of about 9,600 cal. If proper fuel oil was used Sulzer estimates a saving of about 2 per cent. in consumption.	No. 1 speed—400 r.p.m. 172 gr. at 750 b.h.p. 186 gr. at 562 b.h.p. 205 gr. at 375 b.h.p. No. 2 speed—500 r.p.m. 167 gr. at 1,300 b.h.p. 171·3 gr. at 960 b.h.p. 190 gr. at 645 b.h.p. 250 gr. at 325 b.h.p. No. 3 speed—600 r.p.m. 167·7 gr. at 1,900 b.h.p. 169·5 gr. at 1,300 b.h.p. 181·1 gr. at 950 b.h.p. 222 gr. at 550 b.h.p. No. 4 speed—700 r.p.m. 175 gr. at 2,200 b.h.p. 175 gr. (approx.) at 2,000 b.h.p.	All with supercharger in operation and all b.h.p. values at gear output side.

Actually, a minimum full load fuel consumption of 185 gr./b.h.p. hr. was stipulated by the P.L.M.

Pressure-Charging

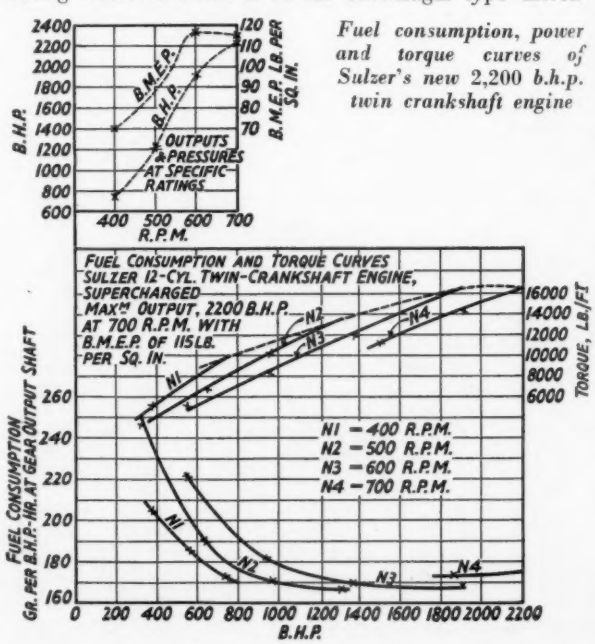
The engine has two Rateau turbo-blower superchargers running at 11,000 r.p.m. with the engine under approximate full-load conditions, and the air delivery pressure is 1·345 kg. per sq. cm. absolute (19 lb. per sq. in. absolute or 5 lb. above atmospheric pressure). The Rateau turbo-blowers are mounted on welded steel frames at each end of the engine, each blower supplying the six cylinders nearest to it, that is, three in each bank. A safety device is incorporated to diminish the fuel injection to the six corresponding cylinders should the blower pressure fall for any reason. The blower itself is of steel and the casing of aluminium.

The injection is direct, by two Bosch pumps through Sulzer injection nozzles, the injection pressure being about 275 kg. per sq. cm. (3,900 lb. per sq. in.). On each cylinder bank is a double-barrelled fuel filter, only one barrel of each filter being in operation at a time. The movement of a small handle on top brings one or other of the barrels into use, and is turned by the driver or shed staff every day, or every week or less, depending on the quality of the fuel. The engine cooling water is circulated round this filter and assists in warming the fuel before injection.

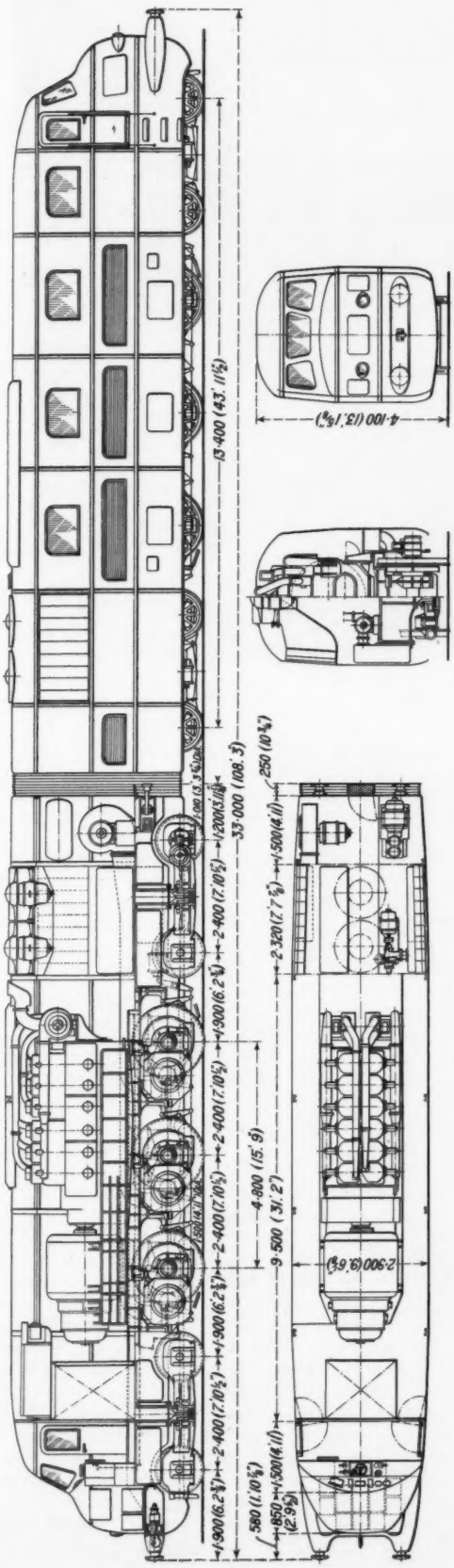
Lubrication and Water Circulation

Lubrication of the engine is ensured by two engine-driven pumps, and the system operates at a normal pressure of 2½ kg. per sq. cm. (35 lb. per sq. in.). There is an electro-pneumatic control system which shuts down the engine and lights a lamp in the driving position if the pressure drops to 0·8 kg. per sq. cm. (11·5 lb. per sq. in.) or less. The lubricating oil consumption is about 2½ gr. per b.h.p. hr. for the engine, but the lubrication of the superchargers and the step-up gears for the main generator also are provided from the engine oil pumps. The gears for the two oil pumps are located at the end of the engine away from the generator, and between the end bearings of the shafts and the vibration dampers; they are covered by a silumin end casing. The oil temp. is 37 to 40° C. at the entrance to the engine.

There is only one pump for the circulation of the cooling water and this is of the centrifugal type driven


B.H.P.
B.M.E.P. LB. PER SQ. IN.
B.M.E.P.
B.H.P.
OUTPUTS & PRESSURES AT SPECIFIC RATINGS
R.P.M.
FUEL CONSUMPTION AND TORQUE CURVES
SULZER 12-CYL. TWIN-CRANKSHAFT ENGINE, SUPERCHARGED
MAXIMUM OUTPUT, 2200 B.H.P. AT 700 R.P.M. WITH B.M.E.P. OF 115 LB. PER SQ. IN.
N1 = 400 R.P.M.
N2 = 500 R.P.M.
N3 = 600 R.P.M.
N4 = 700 R.P.M.
FUEL CONSUMPTION GR. PER B.H.P.-HR. AT GEAR OUTPUT SHAFT
TORQUE, LB./FT
B.H.P.

Fuel consumption, power and torque curves of Sulzer's new 2,200 b.h.p. twin crankshaft engine



Elevation, plan, and cross-sections of Sulzer-engined twin-unit 4,400-b.h.p. locomotive for the P.L.M. Railway. The original requirements called for a locomotive to haul fast trains of 450 tons from Paris to Mentone, 695 miles, in about 12 hours, and to make this journey without intermediate re-fuelling

by a separate electric motor of 6 h.p. As with the lubricating oil circuit, a safety device is incorporated to show a light in the cab and shut down the engine should the water pressure drop below a certain figure. At entrance to the engine the normal cooling water temperature varies from 45 to 55° C. The joint for the water circulation between heads and cylinder water jackets is through pipes with a rubber joint section about 1 in. or so long.

Constructional Details of Engine

The crankcase and cylinder block for the whole engine is in four parts, of cast steel; the cylinder block is in two halves each containing six cylinders (three in each bank) and welded on the transverse centre line to its fellow. The crankcase is in two corresponding halves welded together, but the cylinder block and crankcase are bolted together, the joint line being some distance above the crankshaft centre line. The transverse members of the crankcase which carry the main bearings are integrally cast with the main structure. The bearings themselves and their caps are fixed in the crankcase through double taper keys and a locking device at each side. The sump is of light welded steel plates, and the cylinders have C.I. wet liners forced in.

Each cylinder head is separate and is made of cast iron. The heads carry one inlet and one exhaust valve which are driven through the usual type of rocker with double springs. The rockers have bronze bearings and are operated by long push rods encased in turned steel tubes swelled at the bottom end to form a combined screw and nut-head. There is a separate nickel steel camshaft for each line of cylinders; it is located to the outside, and is driven by gears. It is carried in bronze bearings.

The crankshaft is made of the usual Sulzer brand of special carbon steel. Both pins and shafts are hollow-bored, the bore being covered at each end with screwed caps. The seven main bearings for each shaft have steel shells with whitemetal lining over the whole surface, but the big-end bearings have whitemetal on bronze shells. The connecting rods are of I-section nickel-chrome steel and have four big-end bolts. A hole is drilled up the centre of the rod for the lubrication of the hollow gudgeon pin which turns on the rod and is fixed in the piston. The pistons are of forged aluminium alloy and weigh 45 kg. (100 lb.) each; they carry five pressure and two scraper rings. The injection nozzle is of the multi-hole type placed centrally above the piston crown, which is dished right round the central raised point.

The engine measures 4·2 m. long (without superchargers), 1·9 m. high above crankshaft and 1·1 m. below, and 1·95 m. wide. Its weight empty, but with welded steel underframe carrying engine, step-up gears and main generator, is 23 tons, or 11·45 kg. (25·3 lb.) per b.h.p. Exclusive of this underframe the weight is about 9·5 kg. (21 lb.) per b.h.p. corresponding to an engine weight of 21 tons. At the normal full load rating of 2,200 b.h.p. at 700 r.p.m. the piston speed is 1,795 ft. per min. and the brake m.e.p. no less than 115 lb. per sq. in. On the continuous rating of 1,900 b.h.p. at 600 r.p.m. the piston speed is 1,540 ft. per min. and the brake m.e.p. 116 lb. per sq. in.

Electrical Transmission

Jeumont electrical transmission is used in these P.L.M. locomotives, but Sulzer's servo-motor and governor rheostat regulation of the power output of the engine is incorporated, this being on the same principle as used on the Buenos Aires Provincial railcars built in conjunction with Brown Boveri. Owing to the twin crankshafts of the engine, it was necessary to have a gear drive to the

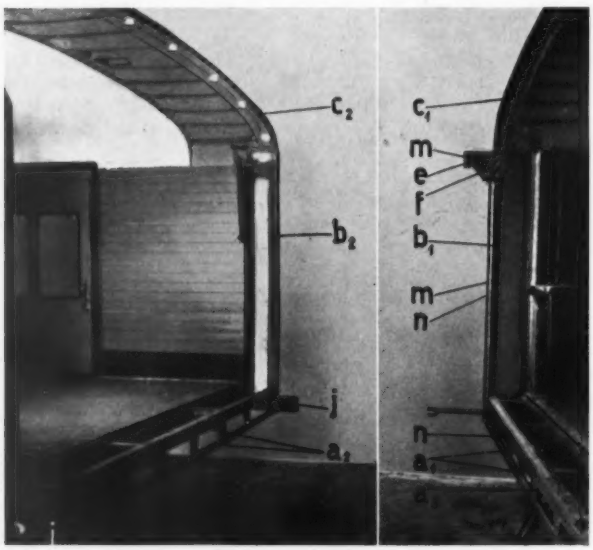
(*Continued on page* 973)

A RAILCAR SHIPMENT PROBLEM

Details of a partial dismantling to suit ports with few unloading facilities

Divided portions of Argentine broad-gauge cars about to leave Budapest

IN the issue of this Supplement for May 15, 1936, were described the 34 Ganz diesel cars built for the Argentine State Railways, and which were divided up among the metre, standard, and broad gauge systems. The broad gauge cars are three in number and operate on the isolated sections from Puerto Deseado to Colonia Las Heras and from Comodore Rivadavia to Col Sarmiento, both far south of Buenos Aires and both without any connections with other lines.



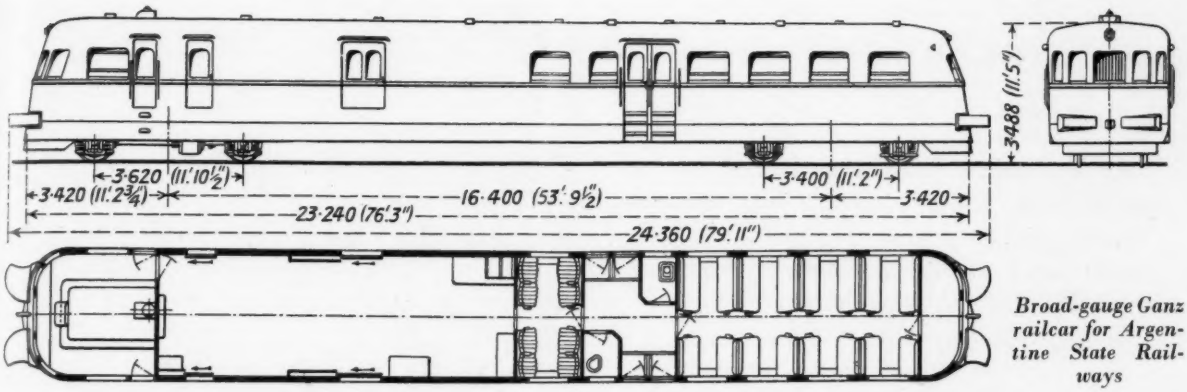
a_1–a_2 —Underframe cross girders
a_3 —Gusset plates
b_1–b_2 —Body pillars
c_1–c_2 —Roof arches
e —Connecting angle iron
f —Upper gusset plate
j —Connecting channel iron
m —Welding holes
n —Holes for fitted bolts

Opposite halves of car frame joint

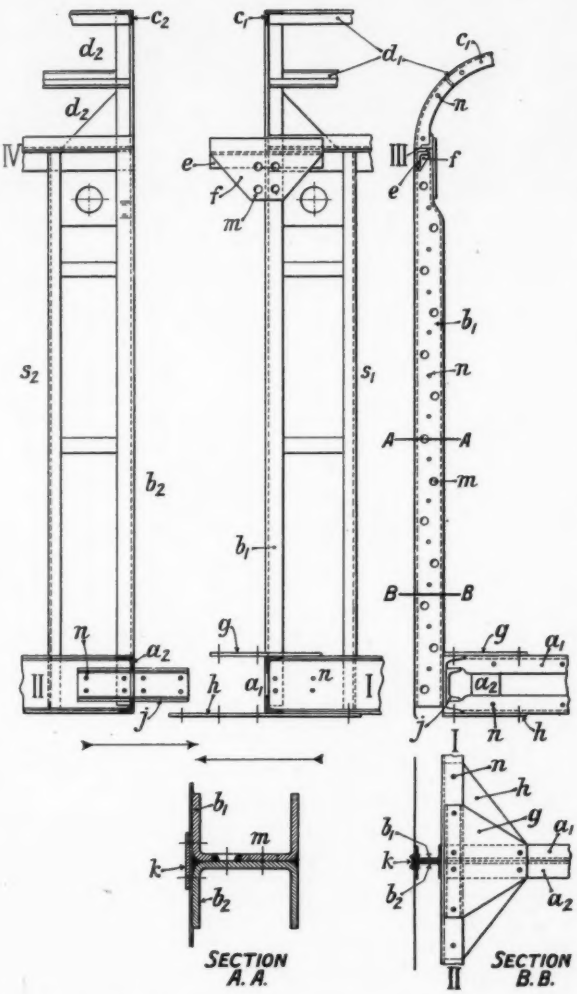
Originally it was intended that the cars should be delivered to Buenos Aires, but when the construction was well advanced instructions were received that the cars must be shipped to Puerto Deseado and Comodore Rivadavia. A further complication was that neither of these ports had lifting or transhipping facilities for handling cars of such length (80 ft.), and all the cars of the order had been built with a view to shipment in a fully erected condition.

The broad-gauge vehicles therefore had to be cut in two and the halves shipped separately, and so far as the integral body framing and underframes were concerned this cutting in two must be taken literally, for the structures were finished. The car bodies were not completed at the time the amended shipping instructions were received, and the design was altered so that the two halves of the body could be shipped separately and joined together on the site, partly by bolts and partly by means of welding. The arrangement adopted is illustrated on the accompanying drawing. The division was effected in the luggage compartment between the pillars S_1 and S_2 of the car bodies, at which place the solebars of the already completed underframes had to be cut in two by means of autogenous cutting.

In order to enable the two halves of the underframe and of the car body to be fixed one to the other in a simple and easy manner, but without diminishing the mechanical strength of the structure, each of the two car halves was fitted with a frame, which were capable of being fixed one to the other like the flanges of pipe connections. This closed frame was constituted by the transverse girders a_1 and a_2 in the drawing, each composed of two angle irons connected in suitable places by welded gusset plates a_3, and of the stamped channel pillars b_1 and b_2, and the roof arches c_1 and c_2. The



Broad-gauge Ganz railcar for Argentine State Railways



S_1–S_2	—Existing body pillars	*g*, *h*	—Lower gusset plates
a_1 a_2	—Cross girders of underframe	*j*	—Connecting channel iron
a_3	—Gusset plates	*k*	—Covering rail
b_1–b_2	—Body pillars	*m*	—Welding holes
c_1–c_2	—Roof arches	*n*	—Holes for fitted bolts
d_1–d_2	—Roof stays	*I–II*	—Cut parts of solebar
e	—Connecting angle iron	*III–IV*	—Cut parts of roof-frame
f	—Upper gusset plate		

Drawing of body joint for Ganz cars shipped to the southern lines of the Argentine State Railways

transverse girders a_1-a_2 were welded to the end of the solebars *I* and *II*, and the lower ends of the body pillars b_1 and b_2 were likewise welded to the ends of the solebars, but the upper ends were welded to the ends of the upper body frames *III* and *IV*. The two ends of the subsidiary roof arches c_1 and c_2 were also fixed to the body frames *III* and *IV*. The mutual fixing of the closed frames thus formed, and thereby of the two car halves, was effected on the site by means of welding and bolted connections. The welding seam, as visible at the section *A-A*, runs along the pillar edges, and in the same way the cross girder and roof arch angle irons were fixed to each other. The steel channel pillars, having a greater height of web, were also fixed one to the other by means of the welding shown in the section *A-A*. These welding seams were on the lower edge of a sufficient number of welding holes drilled into the pillars b_1 of one of the body halves. Further, the fitted fixing bolts by means of which the two frames were secured to each other were put in position first in order to hold the structure for welding.

For the purpose of further reinforcement the channel irons marked *j* connect the solebars *I* and *II*, as well as the gusset-plates *g* and *h*, which connect the cross girders a_1 and a_2. These connecting members are joined by the welds *m* and with the bolts *n* as well as by the seam welds. The junction of the external plate sheathing of the two car parts thus assembled was covered by the rail *k* which is fixed by countersunk bolts through the sheathing plate to the channel iron pillars.

One of the attached illustrations shows the joining of the car halves and the assembly of the underframe and indicates how the various air and water ducts and cable lines were connected by flexible members, as if two independent cars were concerned. The illustration at the head of the article shows the six half cars each loaded on a separate wagon ready for dispatch from the Ganz works.

U.S.S.R. RAILCARS.—Several large double bogie diesel-electric railcars have been built in the U.S.S.R. within recent months, and are operating on various services on the 5-ft. gauge lines radiating from Moscow.

SULZER ENGINE TRIALS.—One of the Sulzer six-cylinder vertical 6LF19 railcar engines, rated in this case at 280 b.h.p. at 1,200 r.p.m. underwent the regular tests instituted by the Automobile Club of France in conjunction with the French railways, some particulars of which were given in our issue of October 30, 1936. The Sulzer engine fulfilled all the requirements in a most satisfactory manner —including a continuous run of 72 hr. at normal load and speed. The fuel consumption averaged 181·5 gr. per b.h.p.hr. at full load; 177·3 gr. at 0·9 load; and 182·1 gr. at 0·75 load.

THE WINTON TWO-STROKE RAILWAY OIL ENGINES

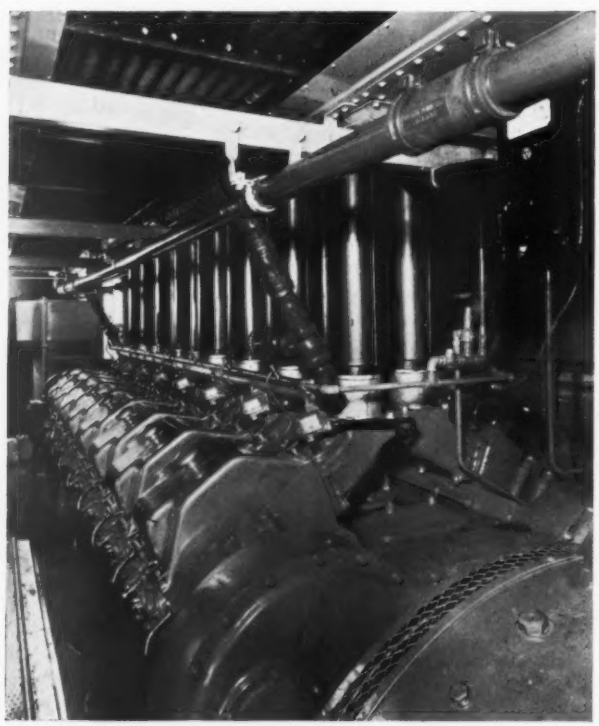
This well-known American design has a compression ratio of 16 to 1 and a maximum cylinder pressure of about 850 lb. per sq. in.; the 1,200 b.h.p. vee model is about 16 ft. 6 in. long, 4 ft. 8 in. wide, and 6 ft. 9 in. high without air filters

660 b.h.p. eight-cylinder vertical engine with attached generator

FEW oil engines in railway service have attracted more attention than the two-stroke Winton models, largely because of their incorporation in the much-advertised super-speed trains of the Burlington Zephyr, Union Pacific and other types exploited with such success in the United States. Although at the moment they are not used outside North America, their application there has been such that they are far and away the most extensively used railway two-stroke engines.

Range of Models

These engines are made in three models, with 8, 12, and 16 cylinders respectively, but some confusion as to their rated outputs exists because it is the practice of the Winton Engine Company (a division of the General Motors Corporation) to give the power output after the power absorbed by engine-driven auxiliaries has been deducted. Thus, the 8-cylinder vertical model as used in the three-car Burlington Zephyr is usually stated to be 600 b.h.p. at 750 r.p.m. but this is the power available for traction and the engine actually develops 660 b.h.p. at the same rotational speed, 60 b.h.p. being required for the auxiliaries, all of which, whether driven directly or indirectly, obtain their power from the main engine. But in the larger sizes it has now become customary to carry separate engine-generator sets owing to the relatively great demands of brakes, air-conditioners, restaurant cars, &c., on the long trains now in vogue. (See issue of this Supplement for January 22, 1937). The ratings have been kept at 600, 900, and 1,200 b.h.p. for the 8, 12, and 16-cylinder models, which means that they are less highly rated than formerly, when an addition of something like 10 per cent. was required for the auxiliaries.



16-cylinder 1,200 b.h.p. engine installed in one of the Union Pacific trains

The leading characteristics of the Winton engines are given in the accompanying table, from which it will be seen that the brake m.e.p. is reasonably high for a two-stroke engine, although the piston speed is decidedly low. Two of the main features of the engines are the welded steel crankcases and frames and the uni-directional air flow with scavenging ports at the bottom of the cylinders and exhaust ports in the cylinder head. The details of all three models are the same, the main point of difference being in the shape of crankcase-frame structure.

Constructional Features

In both the straight-eight and vee engines the crankcase and cylinder block is formed of plates welded to a skeleton framework, which itself is built up by welding, as may be seen in one of the accompanying illustrations. For both the vee and the straight-eight engines welded rolled steel plate construction has been adopted, with the main frame members made of a special welding quality alloy steel. The vertical members of these frames carry the cylinders loads as straight tension from the upper deck plate to the main bearing studs. The various pieces are flame-cut and welded into a one-piece structure of great strength and rigidity which is stress-relieved by heat treatment before erection in the engine. Top and bottom deck plates and side and end plates are welded to the cross frame members, and bored holes in the upper and lower deck plates take the cylinder liners. The space between the deck plates is used as a receiver chamber for the scavenging air. Access to the interior

Welded steel crankcase of the straight-eight engine

of the crankcase and the air chamber is gained through light cover plates.

The steel seats for the bearings of the crankshaft are secured to the lower bridge pieces of the main cross members by heat-treated nickel steel studs (with a tensile strength of 58 tons per sq. in.) surrounded by tubular dowel pins. The bearing caps are held down by jack screws, the upper ends of which bear against the framing. The crankshaft main bearings themselves consist of interchangeable upper and lower steel shells without shims at the joints, and are lined with Satco, a lead-base metal containing about 98 per cent. of lead plus proportions of barium and calcium as hardening elements, and cast centrifugally to the steel shells. Other elements are used in the manufacture of the metal which are not present in the ingot, and Satco has a low coefficient of friction, a melting point of 600 deg. F., and toughness.

High-tensile nickel-chrome-molybdenum steel is used for the crankshaft. Both the shaft and pins are hollow-bored, and ground on the outside surfaces, and holes are drilled from the main journals through the cheeks and crankpins for pressure lubrication. In the straight-eight engine the main bearings are 6·5 in. in diameter and the big-end bearings 6·0 in., but in the 12- and 16-cylinder vee engines the main bearing diameter is increased to 6·75 in. The I-section connecting rods are 19·25 in. long in the vertical engine and are drop-forgings of nickel-chrome steel; at the big ends they have steel shells with Satco metal lining. A hole is drilled down the centre of the rod through which oil flows to the gudgeon pin and out in a jet through the top, impinging on the underside of the piston crown, thus giving a certain amount of piston cooling without complicated piping. In the vee engines the opposite cylinders have separate rods working on the same crankpins.

The gudgeon pin is of nickel-chrome-molybdenum steel and has needle roller bearings with a hardened and ground alloy-steel outer race; the inner race is formed by the fully-floating hollow gudgeon pin. There are three rows of needle rollers separated at the ends by hardened steel guide rings. The pistons are of forged nickel-copper-aluminium alloy, ground over the full length, and fitted with five pressure and two scraper rings; the bushings for the gudgeon pin are of bronze.

The nickel-chrome cast iron cylinder liners are of the wet type and have the casting stresses removed by heat treatment. The combustion chamber joint is sealed with a copper gasket and the liner joint against the lower deck plate by a rubber ring. Aluminium casings cover the cylinder heads, which are cast separately of nickel-chrome cast iron. The heads are secured to the liners and cylinder block by nickel steel studs, and can be removed without detaching the exhaust manifold.

Valve and Scavenging Arrangements

Each cylinder head carries four exhaust valves of 2·77 in. diameter which have a lift of $\frac{3}{8}$ in.; they are spread symmetrically round the central injection nozzle. These four valves are operated by two rocker levers through two valve bridges. Each bridge is equipped with two lash

Welded steel crankcase framing of one of the Winton 16-cylinder 1,200 b.h.p. engines

WINTON TWO-STROKE RAIL TRACTION OIL ENGINES

Model	No. of Cyls.	Type	R.P.M.	B.H.P.	Cylinder Bore and Stroke, Inches	Piston Speed, Ft. per Min.	Brake M.E.P., Lb. per Sq. In.	Weight, Lb. per B.H.P.
201A–8	8	Vertical	750	600 (660)	8·0 × 10·0	1,250	79 (86)	20·8
201A–12	12	Vee	750	900 (990)	8·0 × 10·0	1,250	79 (86)	20·0
201A–16	16	Vee	750	1,200 (1,320)	8·0 × 10·0	1,250	79 (86)	20·0

Figures in brackets represent maximum output at same rotational speed.

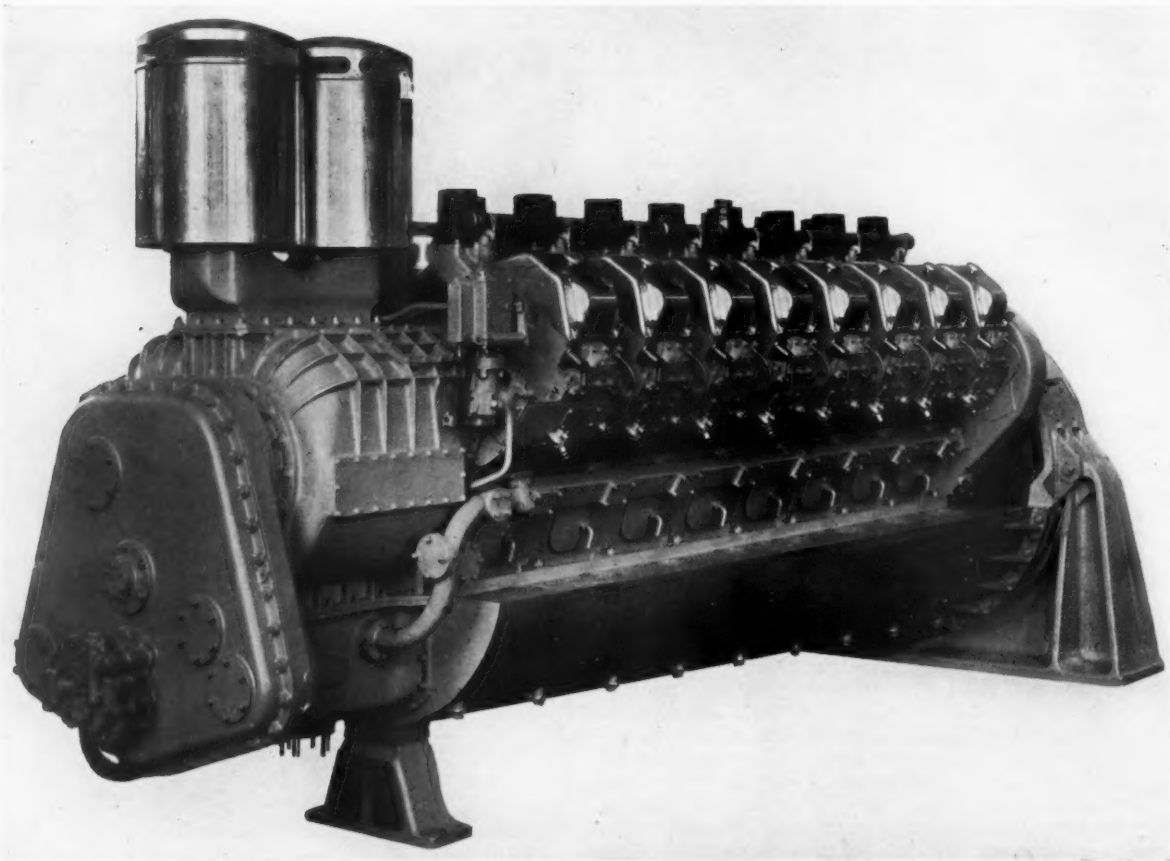
adjuster cams which transmit the rocker motion to the valves and take up automatically any play between the bridge and the valve stem caps. The rockers are operated through short push rods with roller cam followers by the camshaft, which is driven by a roller chain from the generator end of the crankshaft. The cams are of nickel-molybdenum steel, shrunk, keyed and set-screwed on to the nickel-chrome steel shaft, which runs in bronze bearings having babbitt linings.

Air for the cylinder scavenging is provided by a Roots blower at a pressure of 3 to 3½ lb. per sq. in. The blower has two three-lobed rotors; it is mounted on the engine frame and is driven from the crankshaft through a shaft extension and a roller chain. The rotor lobes are helical to produce a uniform flow of air, and have very small running clearances to increase the volumetric efficiency. Heat-treated aluminium alloy is used for the blower housing and rotor castings. Twenty-four slanted scavenging air intake ports, 1 $\frac{29}{64}$ in. deep, encircle the cylinder liner about midway down its length, the air being passed in from the receiver formed by the engine frame structure. The scavenging air flow starts 51 deg. before the bottom dead centre, and about 28 deg. after the four exhaust valves have begun to open. Both the exhaust valves and scavenging ports are open at the same time, so that when the scavenging air is forced into the cylinder by the blower the air flows through the cylinder in a single direction. The fuel spray begins 5 deg. before the top dead centre and continues for 12 deg. past it.

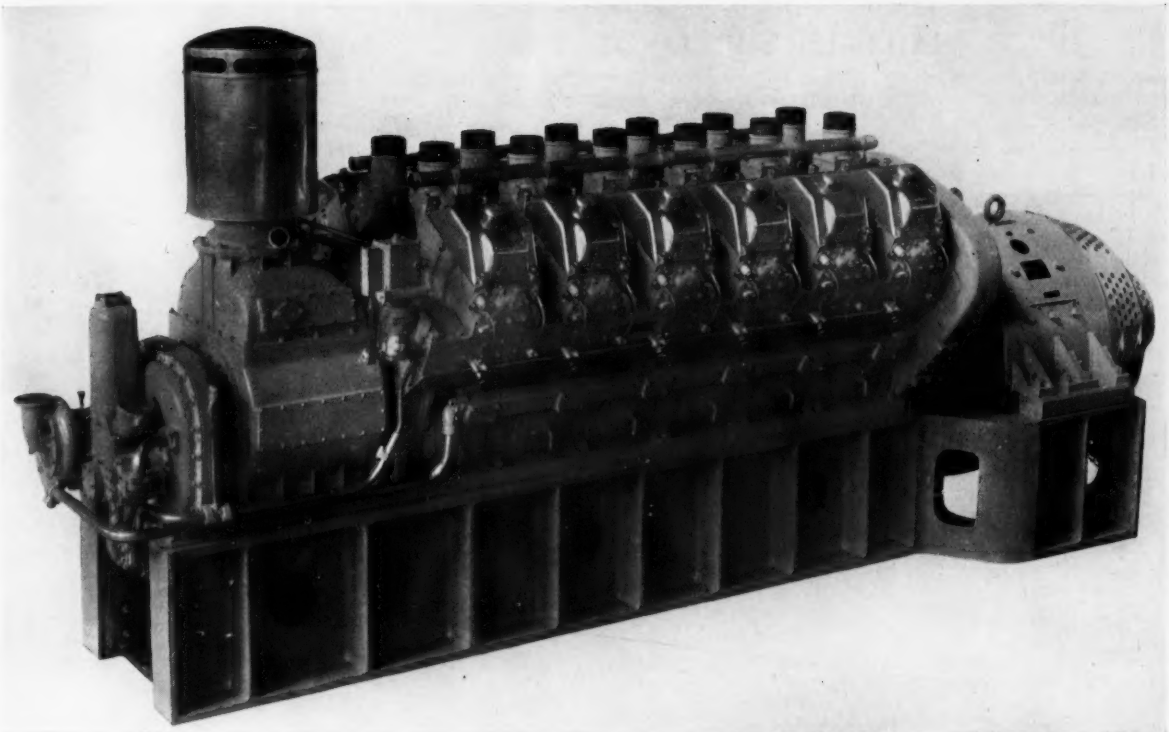
Fuel Injection

A feature of the Winton engine is the fuel injection system. The pump element and injector for each cylinder are in a single assembly bolted to the cylinder head, and this construction eliminates surging in the fuel pipes. As the fuel lead from the transfer pump to the injection pump is under a pressure of only 25 lb. per sq. in., little trouble is experienced with pipe fractures. The combination unit is made up of a pump plunger working in a lapped bushing, both of hardened alloy steel, with the usual two helical edges on the plunger and two ports in the bushing. The fuel pump plunger is moved downwards in a constant stroke by a rocker arm, causing pressure to be built up in the lower part of the injector containing the needle valve and spray tip. The quantity of fuel under compression and the injection lag are very small. The quantity of fuel passed into the engine cylinder is controlled through the rotation of the pump plunger, by the alteration of the position of the helical edges relative to the ports. Oil from the pump casing flows directly to the spray valve, which is lifted by the action of the pressure on the differential area of the spring-loaded needle valve. The valve opens at a pressure of 2,200 to 2,500 lb. per sq. in., and the spray valve has six 0·01-in. holes set at an angle of 75 deg. with the cylinder centre line. Rotation of the pump plunger is effected by a gear and rack connected to the governor lay rod, and by an adjusting device on the bell crank of the lay rod the timing of the various plungers can be made uniform.

Pressure lubrication is furnished by a pump which passes oil through a filter and cooler, and delivers the oil to the crankcase manifold, blower and pump drives, and to the camshaft and rocker arm bearings. Oil from the



Winton 16-cylinder two-stroke engine developing 1,200 b.h.p. at 750 r.p.m.



Winton two-stroke engine developing 900 b.h.p. at 750 r.p.m. in 12 cylinders. Both the engine and the attached d.c. main generator are mounted on a common underframe of welded steel

crankcase manifold is delivered to the main bearings and thence through holes in the crankshaft to the big-ends, From the crankpins oil goes through drilled passages in the connecting rods to the gudgeon pins and (for cooling) to the underside of the piston crown. The oil for the chain drive of the camshaft also is delivered from the crankcase manifold. The used oil drops to a pan, where it is picked up by a second pump and returned to the supply tank. The pressure and second pumps form a single assembly, and are chain driven from the blower end of the main crankshaft; the chain drive extends also to the cooling water pump.

4,000-b.h.p. Locomotives for P.L.M. Railway—

(*continued from page* 967)

main generator, and opportunity was taken to increase the speed of the generator and thus reduce its size and weight. The gear ratio from the two crankshafts to the central main armature shaft is 42 to 35, that is 1·0 : 0·833, and giving a generator speed of 840 r.p.m. with an engine speed of 700 r.p.m. The gear shaft bearings are of white-metal in steel shells, and the teeth are of the straight type with a width of about 27 in. They are lubricated by oil circulated by the engine oil pump.

The Jeumont main generator has a rating of 1,420 kW. at 835 r.p.m. with 790 volts 1,800 amp., this being the one-hour rating corresponding to the 2,200 b.h.p. of the engine. The continuous generator output is 1,220 kW. at 750 r.p.m. (625 r.p.m. engine speed) with 790 volts and 1,545 amp. The auxiliary generator is of the over-hung type on a prolongation of the main armature shaft, and has a rating of 100 kW. at 750 r.p.m. and 160 volts 625 amp. The complete locomotive has six forced-ventilated nose-suspended traction motors, but the power and transmission set of each half (that is, one 2,200 b.h.p. engine, main generator, three traction motors, auxiliaries and control gear) can be operated separately if desired.

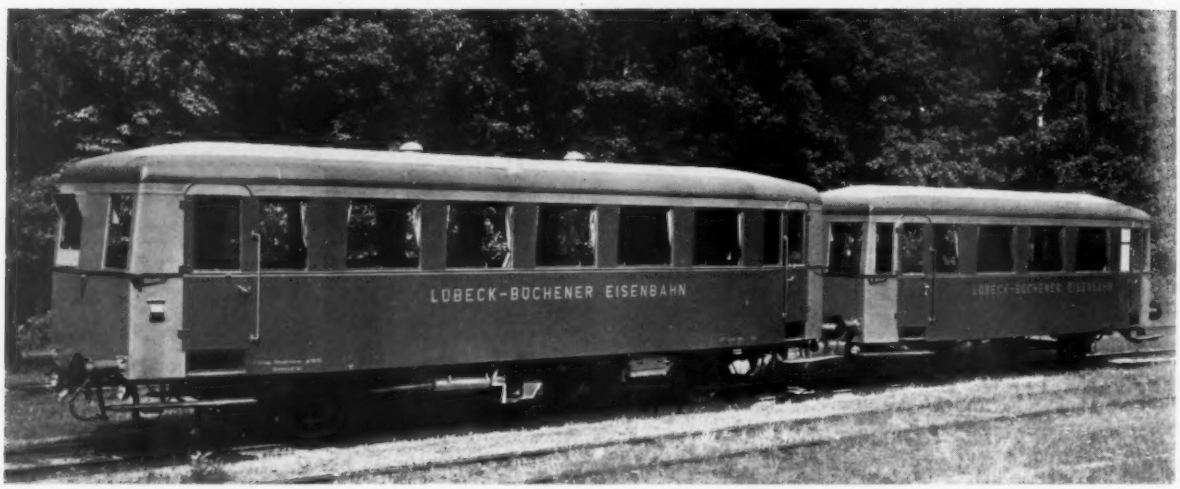
EGYPTIAN RAILCARS

As recorded in the last issue of this Supplement, the first of the new close-coupled Ganz diesel cars has been delivered to the Egyptian State Railways, and some of them began to run on the Helwan line on March 25. From May 1, two of them have been running on the Cairo—Port Said line, making one trip a day in each direction with three intermediate stops. The distance of 147 miles is covered in 3 hr. 25 min., compared with the present fastest time of 4 hr. The ten single-unit cars delivered in 1935 are at work on the Cairo—Suez, Helwan and Zaqaziq—Benha—Port Said sections. The maintenance of these engines, as was foreseen, presented certain difficulties, as they were of a type new to Egypt. It is being carried out by contract with the makers, who employ a staff of one engineer and five trained mechanics of their own, and 30 skilled and semi-skilled Egyptians. Every effort is being made to train the Egyptian staff in this work. The air-conditioning plant has not been altogether satisfactory and Ganz is endeavouring to put this right. Up to date, the cars have run a gross total of 238,000 km. (148,000 miles). There have been nine failures, which averages out at one failure per 25,300 km. (15,700 miles), a satisfactory result under such conditions.

RAILCARS FOR LOCAL TRAFFIC IN GERMANY

Vehicles with high power-weight ratio are described

By Ing. KARL LANGE

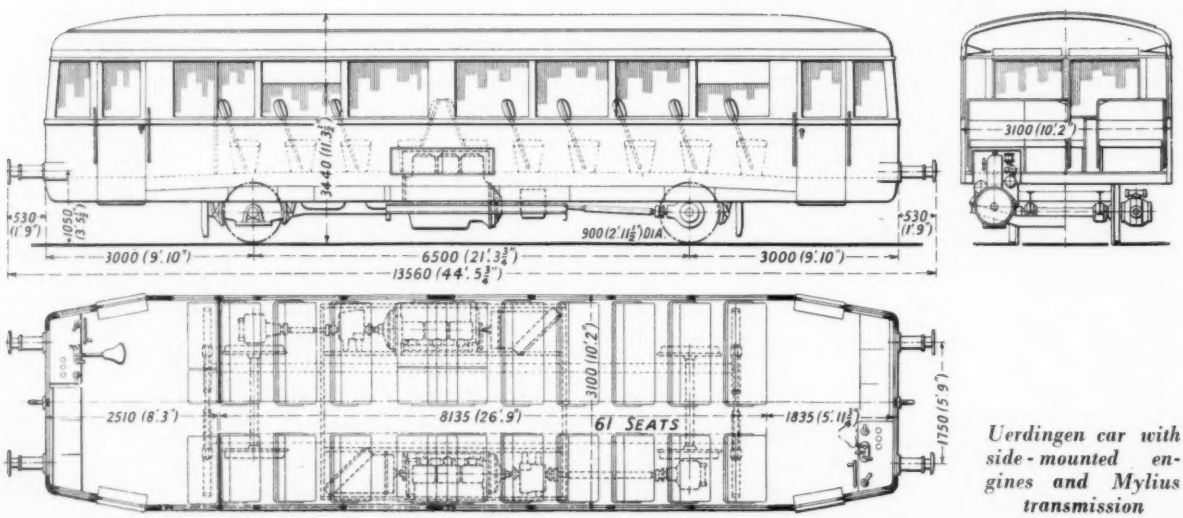


230 b.h.p. Wumag railcar with special light trailer

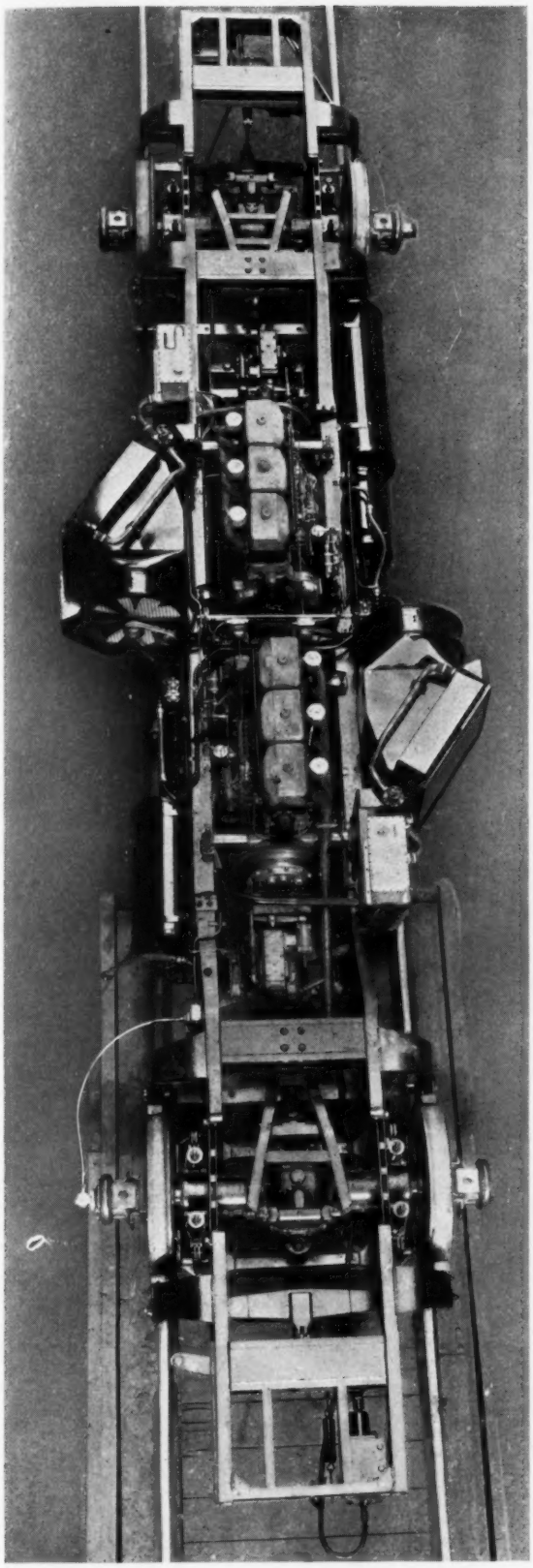
BEFORE the completion of the double-deck steam trains which have attracted so much notice, the Lubeck-Büchen Railway, Germany's largest private line had ordered two diesel-mechanical railcars, which were to be of somewhat different designs in order to try out two types of drive and power plant suspension. Both cars are now in service. In each case the engine and gearbox are the same, but different types of axle drive are incorporated. One car was built by Wumag and the other by the Waggonfabrik Uerdingen.

The engines are of the four-stroke six-cylinder vertical Vomag type developing 115 b.h.p. at 1,500 r.p.m.; the cylinders are 110 mm. by 160 mm. (4·33 in. by 6·3 in.). Bosch fuel pumps and starting motor are fitted, and the radiator fan is belt driven from the engine shaft. Although the location of the engines is quite different in the two cars, the position and size of the two sets of radiators are identical, as may be seen from the accompanying illustrations. The Mylius four-speed gearbox has gear ratios of 5·25, 2·78, 1·575, and 1·0 to 1, and has the standard Mylius mechanical-pneumatic control which enables one or both engines to be controlled from either driving position. Each car has two engines driving separate axles. The seating accommodation is 61, and ventilation is assured by two electrically-driven fans in the roof of the saloon and by two half-drop windows on each side. A hot-water heating system is maintained by a coke-burning stove placed beneath the underframe.

In the Wumag car the two oil engines are placed centrally end to end and are mounted on a special subframe located beneath the underframe, the car floor being raised to clear the cylinder heads. This subframe carries



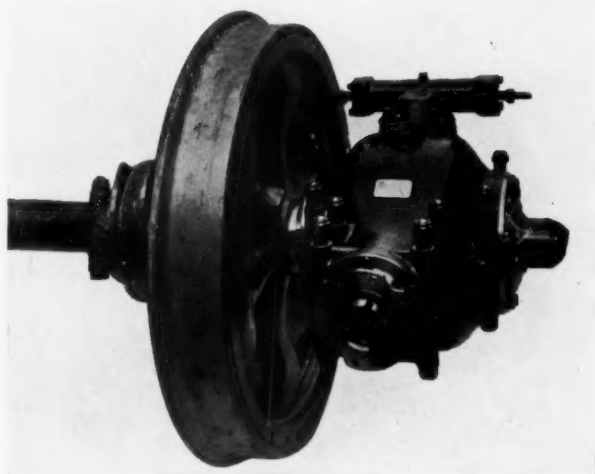
Uerdingen car with side-mounted engines and Mylius transmission



Sky-view of the chassis and power equipment of the Wumag car for the Lubeck-Büchen Railway

the gearboxes, engine accessories, tanks, and Knorr air brake compressor and apparatus. It is made up to two main longitudinal members of deep section cross braced at suitable intervals, and supported on the two axles through special sprung members. The reversing gear is incorporated in the axle bevel drives, which are at the centre of each axle. This car is 40 ft. long over the body and has a wheelbase of 23 ft.; the wheels are 2 ft. 11½ in. in diameter and the tare weight is 18 tons. In order to meet peak-hour requirements, a special lightweight trailer was built by Wumag for operation with this railcar. It is of the non-driving four-wheeled type and seats 43 passengers on a tare weight of 8 tons and within a body length of 30 ft. 7½ in.; the wheelbase is 14 ft. 9 in. Both railcars and the trailer have reversible seats.

The Uerdingen railcar also is of the four-wheeled type, but in an endeavour to eliminate noise, smell, and vibration in the passenger saloon (a particular requirement laid down by the railway company) the Q-bus type of engine mounting as used by the A.E.C. for the Great Western Railway cars has been adopted. As may be seen from the drawing on the previous page, the engines are slung out from the underframe midway along the car, and the



Special type of Mylius drive on the outside journals of one of the Lubeck-Büchen railcars. The axleboxes themselves are inside the wheels and supported directly beneath the underframe longitudinals

cylinders are enclosed in boxes arranged beneath the seats and encroaching on the leg room only to a small extent. The underframe has two main longitudinals between the wheels, and the supporting subframe for each engine is cantilevered from these two longitudinals, but the two supporting frames are quite separate, and the main cross member goes *through* the main longitudinal on the side nearest the engine. A special type of Mylius drive has been evolved to transmit the torque to the axles outside the wheels, the final drive wheels being incorporated on an outside journal. The underframe longitudinals are supported directly on the inside axleboxes, but with the intermediary of rubber pads. This car is 41 ft. long over the body and has a wheelbase of 21 ft. 3¾ in. The floor is slightly raised at the centre, with a taper from the ends, the taper extending also to a part of the luggage room floor and entrance vestibules. As in the Wumag car all wheels are fitted with clasp brakes and the maximum normal service speed is 40 m.p.h.

NOTES AND NEWS

Hunslet Locomotives.—The Hunslet Engine Co. Ltd. is building three 78 b.h.p. shunting locomotives for the Admiralty, which are being fitted with Vulcan-Sinclair fluid couplings.

Hesselmann Engines.—The Société Somua, whose diesel railcars on French railways are well known, has taken out a licence for the construction of the Hesselmann type of engine in the smaller high-speed range.

Irish Diesels.—The close-coupled twin-car set of the Great Northern Railway of Ireland (see issue of this Supplement for June 14, 1935) has now covered a mileage in excess of 110,000 in heavy suburban service on the Dublin-Howth line. The set has Gardner engines mounted on Walker power bogies.

New French Engine.—The Société Berliet, which has supplied oil engines with Acro combustion chambers for various railcars on the P.L.M. Railway, is now building engines with the Ricardo Whirlpool head. The speed of these new engines is 2,000 r.p.m. compared with the 1,500 r.p.m. of the previous models.

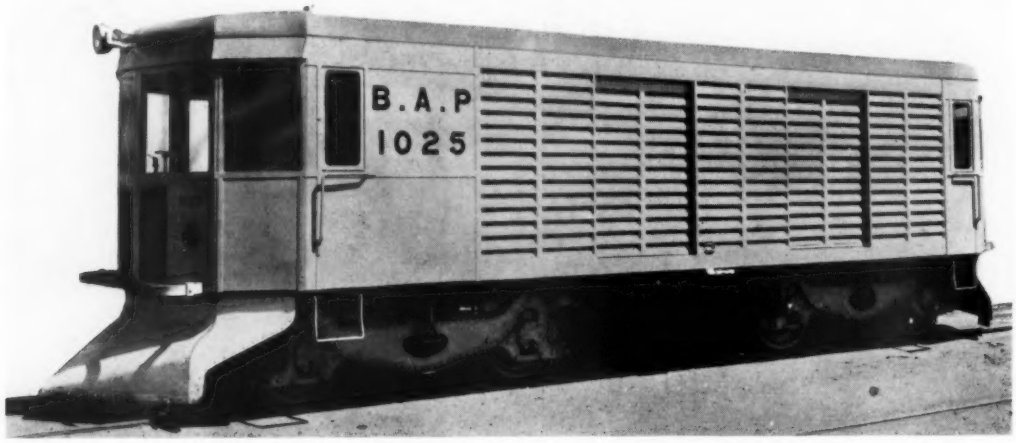
Timken Fuel Pump.—A fuel injection pump for high-speed oil engines is now being made by the Timken Roller Bearing Company in the U.S.A. The range at present includes pumps for engines with not more than six cylinders, and with two ranges of plunger size, viz., 4 to 9 mm. dia. and 5 to 11 mm. dia.

French Repair Depot.—The Chemin de Fer du Nord is erecting near the Gare du Nord a depot for the maintenance and repair of diesel railcars and trains, more particularly the triple-car sets now operating on the fast services between Paris, Lille, and Tourcoing. A fuelling installation and servicing shed is already in use.

American Activities.—The Atchison Topeka & Santa Fè Railroad is proposing to order 11 diesel-electric locomotives. The Missouri Pacific has ordered four 600 b.h.p. oil-electric switching locomotives for use at various points and two 900-b.h.p. locomotives for use on the line between St. Louis (Mo.) and Kansas City, all from the Electro-Motive Corporation. From the same builder the Youngstown & Northern Railroad has ordered two 900-b.h.p. oil-electric locomotives, and another two from the American Locomotive Company.

Minerva Gearboxes.—The Departmental Railways of Dordogne have ordered Minerva gearboxes for 12 double-bogie railcars with 150 b.h.p. oil engines, and nine similar boxes have been ordered for railcars belonging to the departmental railways of Ille-et-Vilaine. All these boxes are of the five-speed type with the four top speeds synchronised.

Small Dutch Diesels.—The Department of State Mines in Holland is purchasing for use in the Limburg district six diesel locomotives with 65 b.h.p. Gardner-Kromhout engines, running at 1,300 r.p.m. Two-speed Bostock & Brainley gearboxes with individual friction clutches for each gear are to be fitted in conjunction with Vulcan-Sinclair traction-type fluid couplings. These locomotives are for use underground, and one of the reasons for the choice of the Gardner type of engine was that tests with previous smaller locomotives had shown the exhaust of this engine to have a very low CO content.



130 b.h.p. Thornycroft-engined petrol car for light goods service on the Buenos Ayres Pacific Railway. It is in use in the Mendoza district

D.E.U.A. Bulletin.—The first yearly progress bulletin compiled by the Diesel Engine Users Association was issued recently and discussed at a meeting on April 14. The report includes a section dealing with the progress made in the application of the oil engine to rail traction, and a bibliography is given as an appendix. The railway section was compiled under the direction of this year's president of the Association, Mr. T. Hornbuckle, of the L.M.S.R.

Fast Railcar Run on G.W.R.—On the occasion of a recent special run with one of the Great Western A.E.C. 260 b.h.p. diesel-mechanical railcars, the 63½ miles from Oxford to Paddington were covered in 65 min., including two stops made for emergency braking and acceleration tests. A distance of 40 consecutive miles was covered at an average of 68 m.p.h.